MISSOURI DEPARTMENT OF NATURAL RESOURCES

LAND RECLAMATION COMMISSION

In the Matter of:		
MAGRUDER LIMESTONE CO., INC., Osage Beach Quarry, Miller County, Missouri, Applicant.	)	Proceeding Under The Land Reclamation Act, Sections 444.760-444.789
LINDA WEEKS, et al., Petitioners,	)	
vs.	)	
LARRY P. COEN, Staff Director, Land Reclamation Program, Division of Environmental Quality, Respondent.	)	

PUBLIC HEARING

JUNE 4, 2008

INDEX

(Original exhibits were retained by the Hearing Officer.)

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MISSOURI DEPARTMENT OF NATURAL RESOURCES
LAND RECLAMATION COMMISSION

In the Matter of:
MAGRUDER LIMESTONE CO., INC., Osage Beach Quarry, Miller County, Missouri, Applicant.) Proceeding Under The Land Reclamation Act, Sections 444.760-444.789
LINDA WEEKS, et al., Petitioners, vs. LARRY P. COEN, Staff Director, Land Reclamation Program, Division of Environmental Quality, Respondent.

This matter came on for public hearing on June 4, 2008, between the hours of 9:00 o'clock in the forenoon and 5:15 o'clock in the afternoon of that day, at the offices of the Missouri Department of Natural Resources, 1730 Elm Street, Jefferson City, Missouri 65102, before Judy K. Moore, a Certified Court Reporter within and for the State of Missouri, in a certain cause now pending before the Land Reclamation Commission, State of Missouri, between MAGRUDER LIMESTONE CO., INC., Applicant; LINDA WEEKS, et al., Petitioners; and LARRY P. COEN, Respondent.

HEARING OFFICER: Let's come to order. The Missouri Department of Natural Resources Land Reclamation Commission is convened in a formal public hearing in the matter of Magruder Limestone Company, Inc., Osage Beach Quarry, Miller County, Missouri, Applicant. This is a proceeding under the Land Reclamation Act, Sections 444.760 to 444.789, Revised Statutes of Missouri, an expansion of Permit No. 0086, Lake Ozark/Osage Beach Joint Sewer Board et al., Petitioners, versus Larry P. Coen, Staff Director, Land Reclamation Program, Division of Environmental Quality, Respondent.

This hearing is being held at 9:00 a.m. on Wednesday, June 4th, 2008, in the Roaring River Room of the Department of Natural Resources Building, 1730 Elm Street, Jefferson City, Missouri. This formal public hearing is a continuation of a hearing that was held on May 23rd and adjourned to this date. W.B. Tichenor, Hearing Officer assigned by the Land Reclamation, presiding. All individuals please turn off their cell phones and pagers at this time and leave them off until the hearing is adjourned.

Applicant appears by counsel Adam Troutwine and Richard S. Brownlee, III, Hendren & Andrae, L.L.C., Jefferson City. Petitioner Joint

Sewer Board appears by counsel Steven Mauer, Bryan Cave, L.L.P., Kansas City. Respondent appears by counsel Timothy Duggan, Assistant Attorney General. Individual Petitioners who are represented by Brian E. McGovern, Mr. McGovern does not appear today and has so notified the Hearing Officer that he had a prior commitment and would not be participating in today's hearing.

With that, I believe we are ready for the continuation of the Applicant's case, and Mr. Brownlee, you may call your next witness.

MR. BROWNLEE: We would call Larry Mirabelli.

HEARING OFFICER: Mr. Mirabelli, would you come forward. Would you raise your right hand and be sworn.

LAWRENCE MIRABELLI,

of lawful age, produced, sworn, and examined on behalf of the Applicant, deposes and says:

HEARING OFFICER: You may have a seat there. And the witness does have at the table with him a copy of Applicant's 9, his expert report.

MR. BROWNLEE: You ready? Everybody ready?

EXAMINATION

QUESTIONS BY MR. BROWNLEE:

Q. Would you state your name for the record, please.

A. Lawrence J. Mirabelli.

Q. What is your date of birth, sir?

A. 10/9/52.

Q. And what is your education?

A. I have a Bachelor of Science chemical engineering degree from Newark College of Engineering.

Q. When did you obtain that degree?

A. 1974.

Q. And what is the name of that institution today?

A. It is now called New Jersey Institute of Technology.

Q. And by whom are you currently employed?

A. I am employed by Dyno Nobel, Incorporated.

Q. And what is your title?

A. I am the senior technical consultant for the Dyno Consult Group, which is a consulting group within our company.

Q. And what is the business of Dyno Consultant?

A. We act as consultants to our customers and

clients.

Q. And in what type of business?

A. In the explosive business.

Q. And what is the business of Dyno Nobel?

A. Dyno Nobel is a commercial explosives manufacturer here in the United States as well as in Asia Pacific. We are the largest explosives producer commercially in North America, so we manufacture all types of explosives and initiation systems, boosters. We also manufacture ingredients for explosives. We are not only a manufacturer; we also transport and store our explosives, we distribute them, and we actually provide a full service loading and blasting.

Q. Do you have any idea how many projects or explosions Dyno Nobel did in North America in 2007?

A. In 2007 I think there was over 30,000 blasts that Dyno Nobel was responsible for.

Q. That was the primary -- the contract blaster; is that correct?

A. Contract blaster service, yes.

Q. And what is your employment history?

A. My employment history is pretty long. I started with Hercules, Incorporated, right out of school, right out of engineering school. Hercules was at that time an explosives producer, explosives

manufacturer. I worked from 1974 to 1984 for Hercules. They hired me as a development engineer, so I developed explosives formulas, processes for manufacturing explosives and moved into the technical services group, which is the field application of explosives.

In 1984 Hercules, Incorporated, was purchased by Ireco, Incorporated, and Ireco again was another manufacturer -- explosive manufacturer, and I continued to work for them from 1984 to 1987. At that time I was a technical service representative, probably a senior technical service representative, and also a regional marketing manager in that time period.

From there I left Ireco and went to work for Mountain State Pit Service. Mountain State Pit Service was a distributor of Ireco and Hercules explosive products, so they not only provided drilling services but also explosives services to coal mining operations, construction operations, quarry operations in the West Virginia, Pennsylvania and Maryland states respectively.

After three years there with Mountain State Pit Services, I decided to go back to what was then called Dyno Nobel, Incorporated. Dyno Nobel

Page 10

purchased Ireco Chemicals or Ireco, Incorporated. So I worked for -- at that -- for Dyno Nobel again, always in a technical role and then through to my current assignment.

Q. And when you say you worked in a technical role, what type of day-to-day work would that involve?

A. That involved applications of explosive products to all industries; construction, mining, quarrying, geophysical prospecting.

Q. Would that include pipelines?

A. Yes. Construction would fall -- when I speak of construction, I kind of generalize that. I apologize.

Q. To summarize, how many years have you had in practical working experience as an explosive engineer?

A. 34 years here in June.

Q. And that would include research and development?

A. And manufacture.

Q. Correct.

A. And -- the majority is explosives application, actually field application of explosive products.

Page 11

Q. And then what about your actual explosive applications from your personal experience? Can you kind of summarize the various industries you've been involved in there?

A. Again, not to repeat myself, but you've asked the question. I have been involved directly in construction blasting, civil construction blasting, underground blasting for both mining and quarrying, surface blasting for mining and quarrying, geophysical prospecting where they're looking for oil and gas reserves, both marine and land, and in a consultative basis also in all three of those major industries.

Q. Are you a member of any professional associations or professional societies?

A. Yes. I'm a member of the International Society of Explosive Engineers, probably have been so for over 28 years.

Q. And what is that group?

A. That's a -- it started as a national group here in the United States. It's expanded to be an international group. It's a group of representatives from mining, quarrying and all of the explosive application areas internationally.

Q. Are you a licensed blaster presently today?

Page 12

A. No. I am not -- I do not currently hold an active blasters license. I have been a licensed blaster in the past. I've held a license in the states of Pennsylvania, West Virginia and Maryland. Generally a surface blasting application or license. In Pennsylvania I also held an underground license.

Q. And that would have been involved in the coal business, I assume?

A. No. It was non-coal.

Q. Oh, okay.

A. Non-coal. You have to have a particular license to blast in underground coal operations.

Q. And have you ever held that license?

A. I haven't. I've worked underground in coal, but not as a blaster.

Q. Do you have any other certifications?

A. Yeah. I am a certified trainer for the MSHA, Mine Safety and Health Administration, for both surface and underground to train miners to be safe according to the miners laws.

Q. And is that concerned mostly with blasting from your expertise?

A. I am fully certified to cover both regulatory as well as blasting as well as first aid.

Q. What services were you asked to provide to

Page 13

the Magruder project?

A. I was retained as a consultant to give my expert opinion on the blasting activities that will occur at the Magruder site.

Q. And when were you retained?

A. My first visit out here was January the 10th.

Q. And was that -- if I recall, was that the site visit that we all --

A. That was my initial site visit, that's correct.

Q. And I think that's when the group of us went down and looked at the project?

A. That's correct.

Q. Have you previously worked with Magruder prior to this project?

A. No. Prior to January 10th I did not work with Magruder Limestone.

Q. Do you have previous work experience in Missouri with the geological conditions in mid Missouri?

A. Yes. I have -- in my 34 years I have worked through the state of Missouri. I've worked in the underground lead mines with St. Joe Lead at the time, now Doe Run Mining. I've worked with Martin Marietta

Page 14

and Lafarge in their surface quarry operations throughout the state, both in the St. Louis metropolitan area, as well as out in the Kansas City area. I've recently finished a project with Capital Quarries Company, Incorporated, at their Holts Summit, Missouri, operation, as well as their California, Missouri, operation and their Stadium, Jefferson City, operation.

Q. And that was Capital Quarries?

A. Capital Quarries Company, Incorporated, yes.

Q. And that's the -- the one in Jefferson City is at Stadium out by Wal-Mart?

A. Stadium is where their main office is, that's correct, that is one of their operations.

Q. Now, have you been involved in the past -- and this is just a matter of background -- in other large scale projects that we all might be recognizing as hearing about?

A. I don't know if you would have heard about them, but as you might expect, in my 34 years I've been involved in many. Most memorable for me because I was directly involved in them, I mean directly actually physically loading and blasting, was, number one, the Niagara Falls Terrapin Point stabilization project, which I believe -- I'm trying to think of my

Page 15

dates back in my mind here, but I think it was in 1982, I think. Forgive me if I don't have my year exactly right, but July I know. And that was to remove 25,000 tons of rock that is on the Horseshoe Falls on Goat Island, which is the U.S. side of the border. And we had to -- to reopen that site for viewing from that, we blasted off the 25,000 tons. Right across the river there is the Niagara Falls power plant that discharges the water from the top of the falls to the bottom in the evening, and the concerns there were the turbines there and their effect from the blasting vibrations.

Another project that I was involved in was the Mt. Lebanon tunnel project. That was in Pittsburg, Pennsylvania, and that involved the construction of two twin tunnels under the city of Mt. Lebanon which was for mass transit from Mt. Lebanon into Pittsburg proper, to the Monongahela River. Those two tunnels were constructed first on the surface. They started on the surface in the city of Mt. Lebanon and then they went under, 60 feet under the city of Mt. Lebanon. Of course, there were churches, office buildings on the surface, as well as utilities.

And then I guess the last project notable

Page 16

which would be the Boston Harbor project which we were involved in for construction of a cut and fill tunnel from the Logan County Airport side of Boston to the east side of Boston. When I say open cut tunnel, rather than tunneling underground, blasting is done from the surface and a trench is excavated and then tubes are welded together and filled. They actually make the tunnel and then they're covered over.

HEARING OFFICER: Excuse me. Is this the Big Dig?

MR. MIRABELLI: This is part of the Big Dig, yes. This is the third tunnel that crossed the harbor.

A. The part that I was involved with directly, I was involved with the blast planning for the dredging operation which was the actual harbor crossing, but as part of this 4,000 feet of tunnel, there was 900 feet when you reach the east side that went inland and joined with a 200-foot diameter cofferdam, concrete cofferdam, that was 110 feet deep into the ground, and we had to excavate that land mass back to the cofferdam.

Q. During that project, were you encountering utilities throughout the project?

Page 17

A. There are utilities, yeah. The cofferdam was actually right in an industrial park and next to a general shipyard, so there were utilities there.

Q. In any of these projects, these major projects, were there any specific considerations given for blasting around utilities?

A. At these that I'm mentioning, no, there was no specific addressing of utilities.

Q. What's the reason for that?

A. They weren't a concern to the contractors or the owners of the properties.

Q. And why weren't they a concern?

A. They were at a distance that did not matter to the project.

Q. Have you had a personal experience in blasting near pipelines for pipeline construction?

A. Yes. Part of my experience and part of my special experience has been with construction of pipelines.

Q. How many years has that extended?

A. I'm trying to think of how far back that goes. Into the 1980's, I'm sure, so 20-something years.

MR. BROWNLEE: I think we're ready for the slide here, are we not?

MR. MIRABELLI: Yeah. You have a slide that would...
MR. BROWNLEE: If we could get the machine turned on at this point, I think we could turn to the slides for further questions.
MR. MIRABELLI: I'm going to go to...
MR. BROWNLEE: First of all, I believe we've previously marked what's Applicant's Exhibit 9.
HEARING OFFICER: Yes, sir.
MR. BROWNLEE: And that's a document presentation called Blast Effects on Sewer Lines, prepared by Mr. Mirabelli.
Q. (By Mr. Brownlee) Is that correct, Mr. Mirabelli?
A. Yes.
Q. And are these slides -- certain ones selected out of this document?
A. The first slide I would be going to would be Slide 7. I apologize for going out of order, but...
Q. That's okay.
A. I tried to capture some of the projects that I've been involved with. I tried to put them in the best chronological order as I could, going with the oldest first. These are fairly large projects, to

give you an idea of my experience with them. The first one was a capacity restoration project that was in the year of 1989. The owner of the pipeline was Texas Eastern. They're now called Duke Energy. The contractor that was doing the construction was Sheehan Construction, plus seven others that were involved in the course of this project. The project involved installing 1,100 miles of 36-inch diameter pipeline. An operating 20-inch diameter pipeline that was put in the ground in World War II, which would be between 1930's, 1945 area, was owned by Texas Eastern and it paralleled the construction at an offset distance of 20 feet from where the new pipe was to be installed.
The project design specifications were revised from a maximum peak particle velocity of 5 inches per second to a maximum peak particle velocity of 12 inches per second. And this was based on a blast study that was done by the group that I show under there, TETCO Engineers, Southwest Research Institute, Battelle Memorial Institute, Vibra-Tech Engineers and ourselves, Dyno Nobel, Incorporated.
Q. Okay. Now, we've heard a lot of testimony on this peak particle velocity. Can you just explain to the Judge the relationship of the peak particle

velocity of 5 inches per second to the peak particle velocity of 12 inches per second? Does that mean you can use more powder at a closer distance, or how does that --
A. The peak particle velocity is the maximum velocity that a ground particle reaches from, in this case, a blast. You can also have a peak particle velocity versus any kind of vibration that might be generated. So 5 inches per second is not moving as fast as something that's moving 12 inches per second. Remember that it's velocity, it's not a distance. It's not like things are moving 5 inches or 12 inches; they are moving 5 inches per second or 12 inches per second.
Q. And how does the peak particle velocity of 12 inches per second compare with the projected peak particle velocity at the Magruder site?
A. The projected peak particle velocities at the Magruder site will be nowhere near the 12 inches per second and they will be below the 5 inches per second.
Q. And for the uncontrolled structure at the sewer plant, what will be the peak particle velocity limit there?
A. That will be the limit as prescribed by the

Missouri State law.
Q. And what is that?
A. I believe it's -- I say believe because I'm not from Missouri, but I think it relates to the Z curve, the OSM Z curve.
Q. Do you know the number of peak particle velocity?
A. It changes with frequency. I think later in my presentation I will show what I calculated, but with regard to the limits set, it would be per the Z curve. I call it the Z curve, Mr. Tichenor, only because --
HEARING OFFICER: Excuse me just a moment.
MR. BROWNLEE: I'm sorry.
HEARING OFFICER: That's all right. I'm trying to keep some order to what I'm looking at. Is the Z curve part of what is referenced as Appendix B in the U.S. Bureau of Mines Report of Investigations 8507?
MR. MIRABELLI: May I see that? I believe it is. You don't have the actual diagram?
HEARING OFFICER: I don't have Appendix B, wasn't able to locate it on site -- on the computer.

Page 22

MR. MIRABELLI: I can provide you with that, if you'd like. I mean, I probably have it here in my briefcase, if you'd like to see that.
MR. BROWNLEE: We can check on a break when we get a chance.
HEARING OFFICER: Okay.
Q. (By Mr. Brownlee) At this particular site of over 1,000 miles, was there any damage to the pipeline as a result of this?
A. No. There was no damage to the pipeline. I think the next slide --
Q. And what was the distance that you were blasting from the existing pipeline for over 1,000 miles?
A. In the course of the 1,100 miles we blasted, we were always within 20 feet of the existing pipeline.
Q. And that was an existing pressurized, what, natural gas pipeline?
A. That was a pressurized natural gas transmission line, yes. That was what was being replaced. That's why it was called the capacity restoration, they were restoring the capacity to that line.
Q. Now, if you'd turn to the next slide,

Page 23

please, that you've selected.
A. I think it's just a -- well, here. This is a project that went from 1992 to --
Q. And I believe this, for reference, is Slide 8.
A. Yes. The owners of this particular pipeline was Pacific Gas and Electric. The engineers that were responsible for the construction were Bechtel Corporation, and the contractors who were doing the installation were H.C. Price, Gregory & Cook and Welded Construction. They are from various parts of the country. The project was to install approximately 850 miles of 42-inch diameter pipeline from the Canadian border, the west side, to Fresno, California. And there was an operating 36-inch diameter pipeline that was built in 1963 that was owned by the Pacific Gas and Electric Company that paralleled the construction at an offset distance here of 25 feet.
Q. So would it be -- how far were you blasting over this 850 miles from the existing pipeline?
A. It would have been within 25 feet. No closer than 25 feet of the pipeline.
Q. Thank you.
A. The project design specifications were

Page 24

limited to a peak particle velocity, the same term that I've used in the earlier ones, of 12 inches per second, and that was based on a study that was done by Lewis Oriard.
Q. And we've made reference to that earlier, I believe?
A. It will probably be referenced.
Q. And the same question we asked before, how does the peak particle velocity of 12 inches per second relate to the Magruder site?
A. The peak particle velocity at the Magruder site will not reach the 12 inches per second, is not projected to reach that.
Q. I think the next one will be Slide --
A. Well, this is the follow-up slide, and it is Number 9, and it basically -- the study that I referred to was actually contracted by the Pacific Gas Company to ensure that the project was going to be able to be run according to the specifications, so it was done earlier than the project, and they actually did -- hired Dr. -- I don't know if he's a doctor, I should say Lewis Oriard, I believe he may be a doctor, one that doesn't use the title, but Lewis Oriard to do the actual study and find out what the vibration specification should be in that

Page 25

particular rock, which was vesicular basalt in that region.
Q. And what were the findings from Mr. Oriard?
A. Well, Dr. Oriard came up with the 12 inches peak particle velocity as their specification, but he tested up to 7 and a half feet to the pipeline without causing damage. And another important finding that he had was the -- when you measure a vibration, of course, the vibration transducer that's measuring how much the ground shakes or the item that it's on shakes, it can be on the surface of the ground and the pipeline, of course, is buried below the ground. So he actually measured on the surface and also on the top of the pipeline. And what he found, that the vibrations on the pipeline are, in fact, lower than the vibrations that are measured on the ground surface. That's an important finding.
Q. Do you want to -- I think the next one would be Slide 11?
A. Yeah. I think it just kind of moves up one time. The next slide would be -- yeah. This is just another summary. Slide 10 is just an additional summary slide that gives some more data about the actual project. Once it actually -- the project actually took place, there were actually some what he

calls final proof tests where tests went beyond what he had recommended that did not cause damage to the pipe.

Slide 11 is the most current project. That is occurring today as we speak. It's called the Phoenix Expansion Project, and the owner of that is the Transwestern Pipeline Company. The contractors doing the work are Gregory & Cook, and they're installing approximately 200 miles of 42-inch diameter pipeline. There's an operating 36-inch diameter pipeline that's owned by El Paso Natural Gas that parallels the new construction at an offset distance of 50 feet. And the specifications for that particular project are a peak particle velocity of 5 inches per second. Blast testing has been completed where we're shooting 16 and a half pounds of explosive per delay. And the measurements that we're getting on the -- at the pipe are 2 to 2 and a half inches per second.

Q. Again, any damage occurred at this point -- or is this one ongoing now or not?

A. No damage. This one is ongoing as we speak. On all the projects that I've mentioned there was no damage to the existing pipeline.

Q. Regarding your knowledge or personal

knowledge of pipeline construction in general, I assume you've had -- been working with pipelines how many years?

A. More than -- more than 25 years of my 34 years of experience directly involved with them.

Q. And what is your -- what is your personal experience regarding pipeline construction?

A. My personal experience?

Q. Well, have you provided training and consulting or anything in those areas?

A. I've actually blasted starting in -- I've actually blasted on pipeline construction work in the Pennsylvania area on projects that aren't even mentioned in this particular area, Mr. Tichenor. And then I have also -- I also have done training for pipeline owners, engineering companies, as well as contractors, with regard to blasting in the vicinity of underground pipelines. I have reviewed project specifications with regard to blasting specifications. I have reviewed blast plans and consulted and advised on blast plans by contractors for blasting near pipelines. And I guess that kind of summarizes just about everything that I've done with them.

Q. What about pre-testing on sites?

A. As part of my consultative work, the one mention there of the blast testing, a lot of companies would prefer that you do some pre-qualifications testing to make sure that the blast plan as submitted will actually perform the way that you've predicted that it will and will meet their specifications. And that's very similar to what Dr. Oriard did at that particular project in the California or the western U.S. area and what we did in Phoenix, Arizona, just to make sure that blasting is done. So I have participated in several of those blast studies and pre-qualification testing.

Q. How many miles would you say that you've provided professional consulting service of blasting on or -- or not on but directly adjacent to existing pipelines?

A. I've consulted on projects that have covered more than 2,000 miles.

Q. And in your experience regarding blasting near pipelines, have you ever known the bedding materials utilized in the adjacent pipeline?

A. In construction of cross-country construction pipelines, there are very much -- there are a lot of specifications that indicate what was done previously, but to actually know what was done,

no, we really don't know exactly what was done in the case of these. In urban civil construction projects it's very difficult to know exactly what was done.

Q. What about the same question for backfill materials? Do you know when you're blasting around these pipelines, do you know what the backfill material is?

A. We know what was specified, but we don't really know what actually is in place.

Q. Do you normally know the depth of the pipelines that are buried?

A. We know as they were specified, yes, but like I say, to say exactly, that I know exactly, I can say -- I have to say no.

Q. What about the joints connecting or the welds that might be utilized? Do you know exactly what those are?

A. In the case of the cross-country pipelines, the transmission lines, yeah, we would know that they are welded pipe. In the case of utility lines, you would only know by specification whether they were, you know, threaded fittings, flanged fittings, or spigot and bell.

Q. So you've been blasting immediately adjacent to high pressure natural gas and high pressure

Page 30

utility lines, and yet you don't know any of those factors; is that correct?
A. We don't know exactly what is there.
Q. Is this significant?
A. It's not significant to what we are doing, no.
Q. Why?
A. Because the exact -- I guess the exact construction is irrelevant to the result.
Q. How would you -- what would you have to do to know the exact? And if you can talk about the Magruder site, what would you have to do to know about the bedding, backfill, depth, compaction, other than that, what would you have to do to know that on these particular lines?
A. The only thing we could do is to excavate the material above the pipeline, and that would be a pretty difficult thing to do. We probably would cause more damage to the pipeline digging it up because we don't know how deep it is than blasting next to the pipeline. That's why -- I mean, it would be difficult. It's a difficult situation because you're disrupting the ground when you're digging, when you're excavating.
Q. And from all your years, you've seen

Page 31

pipelines that have been damaged by either construction; is that correct?
A. Yes.
Q. Have you ever seen a pipeline that's been damaged by blasting that's outside of the actual crater zone?
A. No, I have not seen that.
Q. So the pipelines, have you ever seen one damaged that was actually displaced by blasting?
A. No, I have not seen -- personally seen that.
Q. So to look -- to know exactly about these factors that you've been questioned about on this Magruder site, you'd have to dig those lines up to determine that, would you not?
A. I would have to. I wouldn't do it myself, but they would have to be done in order for me to know.
Q. And compared to the blasting that's going to be conducted in the area, is the digging them up, in your view -- how does it compare to the blasting in terms of potential damage?
A. In my opinion, you would be more disruptive to dig up the pipe than you would to be blasting according to the Magruder blasting plan.
Q. As related to your 20-plus years of

Page 32

experience, how would you relate the blasting difficulty of this Magruder site compared to other pipeline projects?
A. I think you can see in my experience history I am involved in very critical blasting situations. I'm not called in normally for traditional or normal blasting activities. So when I evaluate the Magruder site, it's 99 percent of my other work is more complicated than what's being done at the Magruder site. Magruder site is not anything specialized.
Q. Is that in consideration for both the sewer plant as well as the sewer lines?
A. Yes.
Q. Is the sewer plant, in your view, even an issue in terms of the blasting that will occur at this site?
A. In my opinion it is not. It is not an issue at the distances we are from the plant and the charge weights that are planned to be used, it is not.
Q. And do you know what the distance from the blasting in the initial portion of this project would be from the sewer line -- or sewer plant? I'm sorry.
A. The initial blasting will be more than a thousand feet from the sewer plant and probably more than a thousand feet to the sewer line when it

Page 33

initially starts.
Q. And are those distances critical, in your view?
A. No, not... No. No.
Q. And if you move the -- if you moved into the other non-bonded area, which would be west of -- east of the sewer plant, have you examined the site in terms of what blasting might occur over there whenever in the future that might occur?
A. I didn't physically walk that area, but I looked from the sewer plant over the creek to that area and saw -- just saw the topography of it.
Q. What is the topography in that area?
A. Like I say, there's a creek between the sewer plant and before the grade begins to rise, and I think looking at the topographical maps it was in the 400 to 500-foot area before it reached the elevation of the sewage plant itself.
Q. Is that significant in terms of blasting in that area, whenever it might occur?
A. Well, it's -- it's not significant because you can't -- you've got the creek and valley between there, so there's no rock there to excavate in that immediate area.
Q. But would that have any effect, in your

view, on the sewer plant if you get blasting when you get to that area?
A. No, I don't believe it would.
Q. Regarding your knowledge of the sewer plant we've discussed, have you done any study of the construction of this sewer plant?
A. I was only able -- I was able to review the CD that was given to me with all of the information from the construction type information from the sewage plant and the forced main lines. So I made a review of them, not a detailed review but a review that at least showed me what was there. And I did go to the sewage plant since my deposition to see -- to look at it. I wasn't able to go inside of the plant, but I viewed it from outside the fence area.
Q. Do you know when the plant was built?
A. I don't exactly, no.
Q. Do you know what the sewage holding tanks are made of?
A. I believe the deposition that I looked at mentioned concrete walls.
Q. And are you a concrete expert?
A. No, sir.
Q. Do you know how deep these tanks are in the ground?

A. Again, reading the deposition, I think they ranged anywhere from 10 to 20 feet, but again, don't know specifics.
Q. And they're filled with what?
A. Water mixture.
Q. Is it significant that a structure that's buried in the ground would have any effect from blasting vibration as opposed to a surface building?
A. Buried structures react differently to vibrations, whether they be blasting vibrations or any kind of vibration that's caused in the ground than surface structures.
Q. In what way do they react differently?
A. An underground structure, be it a well or a pipeline, underground utility, a cofferdam similar to what was done in the Boston Harbor, is restricted or restrained. It's not able to move by itself. It has to move only with the ground. A building on the surface is only attached to the ground at its foundation, and it therefore can move independent of the ground based on what vibration is transferred to it by the ground itself.
Q. Have you ever been in the sewer plant?
A. No.
Q. Have you walked around it?

A. I walked around the road side of it, yes.
Q. Do you know how many forced main sewer lines go into that plant?
A. I thought there was two, the plastic PVC pipeline and the 24-inch ductile iron. Those were the two that I was aware of.
Q. Do you know where these two lines enter the plant?
A. On that side nearest the road coming from the Magruder permit area.
Q. And as you face the -- if you're at the plant and you face the -- up towards where the Magruder plant will be, there's a rock high wall, is there not?
A. Yes. Going toward the power lines there's a high wall.
Q. And do the sewer lines come into the left side of that high wall?
A. This side over here.
Q. Left?
A. Left side, yes, depending on which way you're facing. If you're facing the high wall, left.
Q. And on the sewer plant, I assume you've never inspected or checked the valves or any of the piping inside, anything like that?

A. No. Again, I briefly looked at the drawings that came with the construction but did not --
Q. And obviously you've not inspected any of the electronic panels or any of that kind of stuff in the plant?
A. No, sir.
Q. In your view as having experienced blasting around buildings containing electronic materials and pipes and concrete, does it matter that you should know as an expert how that plant's constructed?
A. With the level of vibrations that are going to be generated, no, it doesn't really matter.
Q. Now, turning, if we could, to the pipelines on the Magruder site, what is your knowledge of the pipes?
A. Again, my knowledge is based on what I saw in the information that was provided on the CD, the building -- the specifications that the 18-inch line is PVC. I think it was installed around '84, the year of 1984. And the 24-inch line is ductile iron.
Q. What is ductile iron as opposed to welding iron?
A. It's just a soft -- I would describe it as a softer iron. The specifications were there in the reports that I saw, I think from U.S. Pipe, and it

gave some pressure. I didn't know exactly what was used, but I think the pressure range that I saw was between 200 and 350 PSI, internal pressure reading.
Q. Do you know how the ductile iron is fastened together?
A. I believe it is the mega flange is the way I read it, but I don't know if --
Q. Do you know the specifics on a mega flange connection?
A. I don't.
Q. Do you know the depth of the cover on the ductile iron pipe?
A. In reading the specifications, my understanding was the minimum cover was to be 3 feet.
Q. Do you know the bedding materials?
A. Again, in looking at the specifications, I thought they -- I recall them saying something about passing a 3-quarter-inch size, but I don't really know beyond that.
Q. Do you know the amount of pressure in the ductile iron pipe?
A. No, I don't.
Q. And you're not an expert in pressurizing pipes, are you, sir?
A. No. I'm a chemical engineer. I have

experience with pipes, but I'm nowhere near an expert in the pressurizing of pipes.
Q. And have you done any analysis regarding the potential for traffic over a line like this?
A. No, sir.
Q. And if I ask you the same questions on the 18-inch pipe, would your answers be the same except instead of the ductile iron it deals with the PVC?
A. Yes. Yeah, I don't have experience in plastic pipe, nor the ductile iron pipe.
HEARING OFFICER: Wait just a moment. Mr. Mauer, do you have an objection?
MR. MAUER: Well, I just didn't know when he said, ask you the same questions, I didn't know how far back that extended, because previous the witness testified that he reviewed specifications and things about bedding and flanges for the ductile iron, and I don't know that he could provide that testimony for the PVC. So I just was trying to get an understanding of "ask you the same questions," how far back do those questions extend. That's all.
HEARING OFFICER: Mr. Brownlee, do you want to rephrase?
MR. BROWNLEE: I think Steve might be correct. That's a good point.

Q. (By Mr. Brownlee) Talking about the 18-inch PVC pipe now, do you know what the material is?
A. PVC, as far as I know, yes.
Q. And do you know how the pipe is fastened together?
A. Bell and spigot, I believe, but again, just by reading.
Q. And is that a standard connection that PVC pipe has?
A. I would... I can't really say from an expert side, but it's specified in some other -- in other sewage projects or sewage construction, I would say.
Q. Do you know the depth of cover on the PVC pipe?
A. No. I probably had -- know less about the PVC than I do about the ductile iron just because of the date of the installation.
Q. Do you know the bedding material or side fill around the 18-inch PVC pipe?
A. Not exactly. Again, I recall something about 3-quarter-inch passing on the padding, and I think there was some limitation on the fill about roots, the size of roots or something like that. Those are things that stick in my mind.

Q. Do you know the amount of pressure on the 18-inch PVC pipe?
A. No, but I would assume it's less than the 24-inch main.
Q. Have you done any analysis regarding traffic on top of the 18-inch line?
A. No, sir.
Q. Does your lack of knowledge on the bedding material, depth of cover, condition and fill material regarding the sewer forced main lines running through the property matter to you as an engineer that might be considering blasting around those pipelines?
A. Based on my experience and the distance that we're going to be blasting from those lines, no, it does not matter.
Q. And why is that?
A. Because of the distance that we're blasting and the size of the charges that we're using to blast. The vibration levels will be low enough that the -- whether there's fill -- what type of fill is there is not going to be a matter to the pipeline.
Q. Is blasting around buried pipelines and utilities common in the industry?
A. Pipelines to me -- any construction that's going on in an urban area, there's going to be

Page 42

pipelines either in place or put into place.
Q. And pipelines, are you referring to water lines, sewer lines?
A. I'm talking about utility lines, electrical conduit lines, coax cable lines, fiberoptic lines. They're all -- you know, it's commonplace to be around, yes.
Q. And in any of those applications does the blasting contractor know how the specific lines were installed and depth and construction and fill?
A. No.
MR. MAUER: I'm sorry, your Honor. Speculation how this witness would know what the contractor knows in all of those situations. I don't think there's been foundation that this witness would know what the contractor would know.
HEARING OFFICER: Sustained. I believe the witness needs to be confined to as far as his experience and what he knows from his experience within the industry.
Q. (By Mr. Brownlee) From your experience dealing with blasting in urban areas around this, are people today blasting within 150 feet of utility lines in terms of is that, in your view, a common practice?

Page 43

A. In my experience it has happened, yes, and I was not aware of the specifications for the utilities in the ground. The only thing that I was aware of is call before you dig so you knew where they were located, but you did not know how -- what their construction was.
Q. Are you familiar with the phrase construction blasting versus quarry blasting?
A. I would hope so, yes.
Q. What, in your view, is construction blasting?
A. Construction blasting is blasting that occurs to loosen rock so they can be excavated and not used again, really, you know, taken off the site so that something can be built.
Q. And are the designs in those kind of blasts different than quarry blasting?
A. Yes. Their -- because of their location, because construction is not always out in the rural areas, they are smaller diameter holes, smaller charges, more critical designs. Normally blasting plans are required, and there will be construction specifications.
Q. In construction blasting, compared to a quarry blasting, are there usually more shots or more

Page 44

concentrated than a quarry that might be blasting over a period of a year but maybe twice a month?
A. There's more frequent shots in a construction project because it's not something that goes on for ten years. It's something that has to be done for a specific project. So many yards have to be removed or so many tons have to be removed, and then the building goes on thereafter.
Q. So you could have 24 blasts during a two or three-day period in construction blasting and you could have 24 blasts over a year in a quarry situation?
A. You could have not 24 blasts in a day, but you could have two to four blasts in a day in a construction-type site, but in a mining application, you'd be pretty rare to have one once a -- you know, once a day. You'd have to have a pretty big operation to have more than one a day, just to have the room to do that.
Q. In your opinion, is pipeline construction blasting more challenging than quarry blasting that might occur at this Magruder site?
A. Very much so.
Q. In what way?
A. As you saw in some of the project work

Page 45

there, it is much more close vicinity of the blasting that the explosive charge is to the pipeline than would be occurring in the Magruder quarry site.
Q. And does that require special care and planning?
A. It sure does, yes.
Q. It's not existing at the -- or required at the Magruder site?
A. No. At the distance of 150 feet, it is not required.
Q. Can you turn, if you would, I think back to Slide 5?
A. Is that it?
Q. Why don't you go ahead and, if you can, just as we've done in the past, you might kind of narrate through the purpose of that Slide 5 or what that illustrates.
A. I think it brings some answers to the question you've just asked me in that, you know, how different is pipeline construction than the blasting that will be occurring at the Magruder site. And in the past 20 years there's been considerable activity by natural gas companies to replace their existing lines or to increase the capacity of their existing lines throughout the United States network and also

Page 46

in Canada, of course. And what that means is that they normally share a right-of-way with the current existing line. So there's not a lot of distance between an existing line and the construction that needs to be done. The lines are normally between, you know, 20 inches in diameter to 42 inches in diameter. There are normally 6 to 8 feet -- buried 6 to 8 feet. That would be from the bottom, the bottom of the pipe level. So depending on their diameter, they come within 3 feet of the surface.

Q. Let me ask you a question. When you say they're replacing existing lines, that implies there's a line right next to the one they're putting in.

A. That's correct.

Q. And usually do you have any idea how old those existing lines have been and how long they've been in the ground?

A. The owners of the project would, as I showed you in a couple of the projects. One was World War II that they were replacing there for Texas Eastern.

Q. So that's been in over 50 years?

A. That's correct.

Q. Okay.

A. So you would know. In the case of

Page 47

construction transmission lines, the specifications are very specific. The owners, of course, are very aware of the age of their lines, the capacity of their lines, the pressures that they run. They're the ones that have to move the gas throughout the country, so there it's pretty --

Q. When you're blasting near these existing lines, they don't shut those off, do they, and drain them out?

A. No.

Q. They're transporting product as you're blasting 20 feet away from them?

A. They are transporting product as we're blasting. They may lower the pressure of the line for a specific reason, but not typically.

Q. Continue, please.

A. I think I said the right-of-ways are there. The next diagram kind of shows what you're talking about. There's a sketch. It's not to scale, but it shows the buried operating pipeline. The offset distance, as was mentioned in the specifications, could be anywhere from 12 feet and 20 feet, and that's when it's very critical when you're in that area. And then the blast -- the cylinders that you see there are actually the drill holes where the

Page 48

explosive would be placed to create the trench for the next pipe -- the new pipe that's going to be installed. So it's a much different situation than you would see there at the Magruder.

Q. In terms of complexity, in terms of blasting complexity, is it much more complex than --

A. This is much more complex, yes.

Q. Than the Magruder site?

A. (Nods.)

Q. What -- well, I won't... And in terms of the grade at the bottom of the trench blast, how does it usually compare to the grade of the existing pipeline?

A. In the case as shown there, normally the grade of the new installation will be below or equal to the grade of the existing pipeline. So all of the bore holes in the trench blast are to a grade or an elevation that is lower than the existing pipeline in place. The reason for that is they have to be able to excavate rock to a depth below that pipeline so they could put in the required padding for the pipeline.

Q. And padding is --

A. Padding is crushed rock.

Q. Padding is another word that we talk about?

Page 49

A. Right. Padding is very much specified in cross-country transmission pipelines.

Q. And as a result of this pipeline construction, are you aware of empirical data that has been developed?

A. There has been much empirical data that's been developed with regard to high pressure transmission lines.

Q. And does that data have a reflection or relationship to the blasting at the Magruder site?

A. No. Most of the -- the studies that have been done for cross-country transmission lines are in close vicinity to the lines themselves, and I mean distances of less than 100 feet.

Q. So having no direct relationship, because of the distance at Magruder, it --

A. It removes -- it removes the difficulty, as you mentioned, or complexity of the project itself.

Q. Thank you. Did any of the projects you were involved in in 1992, which I think you mentioned earlier, result in any publication of any empirical data?

A. Yeah. The Lewis Oriard project that was done, that was privately contracted, so that did result in a study that was given to Bechtel and to

Pacific Gas. He also published a book, Dr. Oriard did, and I believe we have that listed. That is Construction Vibrations and Geotechnical -- no. I'm sorry. Explosive Engineering Construction Vibrations and Geotechnical. That was published in 2002. In that book he talks about many of his other projects as well as the experiences he had in doing the study for the pipeline project in California.

Q. Did any of these studies by Mr. Oriard that are -- excuse me. Are these studies relied upon by people engaged in blasting today in the United States?

A. There are some that rely on Dr. -- or Lewis Oriard's publication, yes.

Q. And does your -- do you rely on those?

A. I utilize his experiences, I do, along with other experiences, but I utilize his experiences, because they're practical measurements in the field done by a third party.

Q. And do you have a conclusion that Dr. Oriard -- or Mr. Oriard or whatever he is -- in terms of the distance you can blast safely next to pipelines?

A. Well, in Dr. Oriard's study one of the important conclusions that came out of it was that he

was able to blast to within 7 feet of a pipeline without causing damage. That's an important piece to the puzzle.

MR. BROWNLEE: Can we take a short break? I need to check on an exhibit number here for a minute.

HEARING OFFICER: All right. Let's take -- it's right at 10:00?

MR. MAUER: Two minutes after 10:00.

HEARING OFFICER: Two minutes after. Let's take a recess to a quarter after. We're off the record.

(Brief recess.)

HEARING OFFICER: Let's come back to order. We're reconvened. Mr. Brownlee, you're recognized to continue with your examination of the witness.

Q. (By Mr. Brownlee) Mr. Mirabelli, regarding the empirical studies and the actual blasting experience you have on the pipelines, does the data and the experience you have relate to the Magruder project?

A. Yes, it relates to it in that it is more critical to be -- when you're blasting in close vicinity to a pipeline or buried structure than at

150 feet away from the pipeline.

Q. And you understand the 150 feet would be the maximum?

A. The closest.

Q. The closest that it would exist?

A. That is correct.

Q. Now, I'm going to hand you what we've marked Applicant's Exhibit 22 and ask if you can identify that?

A. That's the Pipeline Response to Buried Explosive Detonations.

Q. Are you familiar with this document?

A. Yes. Yes, I am.

Q. And have you ever used this document in your work?

A. I have. I have reviewed it and do utilize it in some fashions, yes.

Q. Do you use the actual document or just some of the empirical data that might be contained in the document?

A. I use the empirical data.

Q. And is it fair to say that in any of this empirical data, you're not carrying this document around like you might a road map, but you utilize the theories that are developed in the empirical data?

A. There's much to be learned from these studies. These are contracted studies. This was contracted by the American Gas Association.

Q. And what is that association?

A. You'd have to go online. I can't tell you exactly --

Q. But you're familiar with the association?

A. Yeah. There are kind of like a -- they are an industry organization that helps, not regulate, but makes sure that common standards are established for their industry.

Q. Do you know where this document was -- how this document was produced, I mean the source of this document?

A. You -- you're providing it to me from Mr. Dressler?

Q. Is that your understanding?

A. That's my understanding. Yeah. I didn't -- this is not my -- I know this document, but it's not something that I provided.

Q. Okay. Thank you. And have you reviewed this document for purposes of your testimony today?

A. Yeah. I did look through it, and like I say, it's not the first time that I've seen this document.

Page 54

Q. Are there materials in this document that have a direct bearing on the Magruder project?
A. No, there are no materials here that directly relate to the Magruder project. This document strictly relates to blasting within 100 feet of a buried pipeline.
Q. Well, it relates to the Magruder project in that this document is based on a closer blasting than the Magruder project, correct?
A. Yes, if you say it that way.
Q. Does this document have any dealing with the bedding or padding materials around it?
A. No. This study was done in soil, it wasn't done in rock, and so there was no change between the bedding material and the soil it's blasted in.
Q. To your understanding and examination of this document, was there any discussion in here on bedding material?
A. No, sir. Not to my knowledge, no.
Q. Was there any discussion in this document on side fill?
A. No, sir.
Q. What about the same for pipe depth? Any discussion in there regarding the pipe depth?
A. Pipe depth was mentioned in the document,

Page 55

I'm sure, and the depth of the charge, yes.
Q. What about pipe age? Any discussion in there on that issue?
A. Not that I can recall. There could have been.
Q. Does this document provide examples of how peak particle velocity was computed?
A. Yes. It gives formulations for peak particle velocity. That was one of the purposes of the document.
Q. And, again, this is blasting in soil, correct?
A. This is blasting in soil, yes.
Q. Okay. And what page is the peak particle velocity discussion?
A. There are... It is referred to in the document. I mean, this is a very intense document here calculation-wise. There is an example in the back on Page... In Appendix A, go to Page 23, and if you start with me there, maybe I can -- there's an example problem, Number A1, starts on Page 24, and it says a point charge of 2 and a half pounds of 60 percent nitroglycerin dynamite -- that's what the NG dynamite is -- will be detonated buried 4 feet in soil with a density of 120 pounds per cubic foot.

Page 56

That's the density of the soil material that the charge is in. And a seismic propagation velocity of 1,000 feet per second. That's the speed that sound will move through it, but that could be used for the velocity of how a shock is transmitted through the soil also. And then they say the horizontal ground motions at a standoff distance of 15 feet, they want you to find that. That's using their formula, so --
Q. What is the standoff distance?
A. 15 feet. The standoff distance is exactly what I showed in my slide. Right there. See that offset distance? That is the standoff distance as prescribed.
Q. So that would be the distance from the blast from the existing pipeline?
A. From the explosive charge to the pipeline that they're making their measurement to.
Q. So in this case it was 15 feet?
A. 15 feet and 2 and a half pounds of explosive.
Q. And how does that relate to the Magruder site?
A. Well, we are 150 feet, and I believe the worst case charge weight was 200-something. I don't know the number exactly, but... But that's worst

Page 57

case scenario. We'll talk a little bit about that later on. So they go through the -- they put it into their equation that they've developed in this document, and as you go through it there are several steps. On Page 25 there's a C where they substitute all their formulas into place, and you'll see X equals .00491 feet. That's the displacement. That is, according to the calculation, how far the ground might be expected to move, the actual particle. It's pretty small, as you --
Q. Compared to, I think, what, a sheet of paper? How does that compare?
A. It's probably as much as the sheet of -- this sheet of paper.
Q. And is that a permanent displacement, or is that a vibration and it returns back?
A. That's a vibration -- that's the distance it moves, and it comes back to rest.
Q. So this blast produces a vibration displacement of -- temporarily a vibration of less than the thickness of a sheet of paper?
A. In the neighborhood, yeah. It tells you here exactly what they've calculated. That's the calculated. That's the calculated via this study that they've done. Please remember that.

Page 58

Q. Can a scaled distance be computed from this example?
A. Scale distance would be computed based upon the two pieces of information they give to you, 2 and a half pounds, which is the weight of the explosive, and the 15-foot distance. So probably it is a scale distance of 9.
Q. And how does that compare to the blasting on the Magruder site for the uncontrolled structure?
A. Well, it's a much lower scale distance than what we would experience at Magruder. The reason, I guess, we were looking at this was the peak particle velocity. On Page 26 they finally get to the solving of equation 4 for U. U is the peak particle velocity, and as you see there, the calculated peak particle velocity for that charge at the 15-foot distance was 4.46 inches per second.
Q. Now, you said the scale distance was lower. By being lower, is that a greater force on the pipeline than, for example, a scale distance of 55?
A. As the scale distance becomes -- the number becomes lower, the expected type of vibration would be higher. The closer you are.
Q. So a 9 is much --
A. Much less than 55.

Page 59

Q. But much greater in terms of vibration than a 55?
A. It could be. According to the calculation, as you see, it's 4.46.
Q. And does this document indicate whether blasting can be safely performed at the Magruder site based upon the differences, obviously, between what will occur at Magruder and the input or standards from this document?
A. I think that data presented here can be used to relate the difference between what is occurring at Magruder and what has occurred in this document.
Q. And can you summarize that?
A. This document is addressing blasting within 100 feet of a buried pipeline with bore hole depths equal to or greater than the depth of the buried pipeline. At the Magruder site, we will be greater than 100 feet, a minimum distance of 150 feet, and the bottom most elevation of the bore holes will be above the elevation of the pipeline, the top elevation of the pipeline.
Q. You'll note this is apparently a Volume I Applicant's Exhibit 22?
A. Yeah, this is Volume I. This is a summary volume. Volume II of this document is actually all

Page 60

the data that was generated.
Q. Was there a subsequent study done by this group that dealt with blasting in conditions other than soil?
A. Yes. Actually, there was a study done in 1991 -- Southwest Research Institute was no longer existing, but the document was done under contract by the American Gas Association. I think it was the Pipeline Research Council International that actually did the -- did the work for that study. And it was done -- I don't know the exact title. It relates directly to rock, though. I think it was blasting in rock next to buried pipelines.
Q. As opposed to this study, Exhibit 22, that was blasting in soil?
A. That's correct.
Q. And what are the results of the blasting in rock as opposed to the blasting in soil?
A. The results, without having the document in front of me, basically the results showed that the vibration measurements in a multimedia ground that is not just soil to the pipeline but rock and then a trench and then padding or fill material and the pipeline showed that there was a reduction in the vibration measured at the pipeline when it changed

Page 61

from rock to a different material. I'll say different material because I don't know the materials.
Q. Well, let's go another way. Is blasting that is primarily going through rock, is that less likely to create a vibration as opposed to the soil?
A. It transmits the velocity faster, but once it reaches a discontinuity like a trench face, as you can see in that diagram on the board there where the -- and you have a fill material, it changes -- it slows down, then, when it goes to that point. It's a discontinuity in the transmission.
Q. Are you aware of any empirical studies regarding blasting near pipelines performed by the U.S. Government?
A. Yeah. Three years after the American Gas -- after the 1991, so in 1994 the U.S. Bureau of Mines did a study that -- I don't know the title of it, but it's an RI, an RI report, where they blasted from a surface coal mine operation within 50 feet of gas underground pipelines. Let me put it that way.
Q. Would that be the RI 9523 that I think we've referenced and will be referencing again in --
A. That's right. By Dave Siskand.
Q. Who are the participants in that?

A. Amax Coal Company, the U.S. Bureau of Mines, and I really don't know all the -- I think I -- they are listed on one of my slides. There's probably four parties at least.
Q. And do you know how they -- what kind of pipes were involved in that study?
A. I believe Schedule B, there was a steel pipe that was class B or something pipe -- grade B, a grade B pipe, and also a PVC pipe that were included in their testing.
Q. Do you know what the distance was that the blasting occurred in that study?
A. According to my recollection, it was within up to 50 feet to those pipes where they monitored strains as well as vibrations.
Q. And do you know what the maximum peak particle velocity was at that distance on those pipes?
A. I believe it was 24 inches per second is what they actually measured.
Q. And how does that compare to what's at the Magruder site?
A. Again, it's five -- it's almost five times.
Q. Greater?
A. Yes, five times greater than what...

Q. And did any damage occur as a result of this study?
A. No damage was -- no damage was recorded. No damage was recorded in any of the test work that was done. It's a very important learning point, not mentioned, but in all the testing they've done they didn't damage the pipe; they just recorded data.
Q. In your report, and I think other witnesses, they've used the word blast effects. Can you explain to the Judge what you mean by that?
A. Are you ready for this? Blast effects, when we speak of blast effects, the explosive is a balanced mixture of fuels and oxidizers, just like building a fire. You have wood and you need oxygen. If you don't have oxygen, the wood won't burn. The more oxygen you get to your fire, the more it burns.
Well, an explosive is very much a reaction like that except everything is close together. All the molecules, the air and the fuels, are close together. When you initiate them with a booster or a detonator that's of greater energy than the explosive itself, the explosive goes from that solid or liquid that's placed in the hole through a -- what is called an oxidation reduction reaction. So it liberates energy. And that's the energy that causes a blast

effect.
That energy from the explosive has to go into something, so it goes into breaking and fragmenting the rock, into moving the rock somewhere. And then what doesn't go into those two activities has to go somewhere because we can't create energy or destroy energy, so it has to go either into the ground vibrations or into the noise or what we call overpressure in the air. So blast effects are breaking the rock, moving the rock, ground vibration and air.
Q. To maximize the blast effect, you'd want -- if you're in a quarry situation, you want as much of that to go into breaking rock as possible. Is that not --
A. That's correct.
Q. That's the purpose?
A. And that's what we would call an efficient blast design. We want to put as much energy into breaking the rock and as little energy wasted into the ground or into the air.
Q. And is there any relation between the more energy used to break the rock, that is, blow it off the face towards the east as designed, does that have any relation to the amount of -- that's left over for

vibration to go through the remaining rock?
A. There is.
Q. What's that correlation?
A. It is called confinement, and blasting with an open face and delaying the sequence of the blasts minimize the amount of energy that's transferred back into the ground.
Q. And do you understand that's the purpose of I guess this particular blast plan, to achieve that result?
A. That's correct. As I reviewed the blast plan, yes.
Q. Mr. Mirabelli, in your report and a lot of the documents, there's been the term peak particle velocity, and I know that you understand this. Could you explain this, if you can, in terms that we can all understand and how it's relevant to blasting?
A. I can try.
Q. Okay.
A. I can try. You've probably had several other people try. There are several components to -- and we might want to use a slide or two.
Q. That would be fine.
A. It may be confusing, but -- well, let me find it first myself. Okay. We'll go to Slide 13.

Page 66

And I really want to try... When you talk about vibration, we're not only talking about blasting vibration but any vibration. Vibration doesn't have to be just an effect of a blast; it could be an effect of a piece of equipment, a truck rolling over the road, a railroad, a train going down the railroad tracks, a garage door opening in your garage or coming down. They all cause vibrations. And the vibrations that they cause are waves actually moving through materials.

And there's really four basic ways that you can describe the wave. You can describe it by its velocity, as we did with the peak particle velocity. And, again, remember the peak particle velocity is the fastest that it goes. The wave has a velocity all through its life, but sometimes it goes faster and sometimes it goes slower. Okay? So the peak particle velocity is the fastest that it goes. Okay? And that's measured in inches per second here in the United States. In Europe it's measured in millimeters per second, just because of the metric system.

The displacement is how -- what the distance that a particle, let's call it, material, be it ground or be it table or be it wall, moves, the

Page 67

actual physical distance it moves. Not the distance that it moves in one direction, but the distance it moves all the way on its trip. So in the case of a particle that's a distance from us, if I was to stamp my foot here, nobody felt anything, of course, but I excited the particles in the ground and they vibrated out a distance from me. Now, we didn't see anything move, but we know that something has moved. So it moved and it came back to place, a very small distance. And that's what the displacement is. It's measured in thousandths or ten thousandths of an inch.

And as Rich was talking, we're talking about the pieces of the paper here. That's its total trip. That's the distance it came up and then went back to rest. And it's measured in three dimensions. That's what we want to remember, waves travel out in all three dimensions as they're set. The acceleration is how fast it's -- if it's going faster or it could be deceleration or it could be going slower. So when I first hit the ground, it's traveling out fast and then it's starting to slow down as it goes farther along because it's going through the carpet here and the carpet is actually acting like soil and damping, slowing it down faster.

Page 68

If we were on a concrete floor and I smacked it with my foot, it would travel a little bit faster because it doesn't have any way to damper, it travels that concrete. So that's the acceleration and deceleration part.

And then frequency is the amount of times the cycle passes by itself, so the amount of times the particle moves up and down in a second of time. And that's called hertz and that's the important part of the vibration component that the Bureau of Mines addresses in the Z curve that's in the Missouri law and also in the office surface mine regulations. That's that frequency that they address there. And it's very important to how a structure like a house or a garage or anything on the surface reacts to vibration.

Q. Why is that?

A. Because it's what we call an unrestrained structure. It's only attached -- a house is only attached to the ground by its foundation. And if it's a one-story home, it has a -- you know, it has a distance from the ground, and if it's a three-story home, it has a taller distance. And I can't show you here very good, but if I shake the ground, if I shake the bottom of that easel there, the top will -- can

Page 69

shake on its own. So I can only shake the bottom there a couple of inches, the top will begin to shake. If I can get it to a frequency that matches the frequency of the building, it will shake more, more than the ground will shake.

And that's what the bureau shows, that houses and buildings are normally in what they call the natural frequency of 10 to 20 hertz. So you'll notice in the U.S. Bureau of Mines curve that the higher the frequency, so the faster something is shaking, the higher the threshold of the velocity. It's very difficult to explain.

If we had a rubber band -- do you have a rubber band? That bungee might work. Here, a rubber band will work better. I'll try to make a primitive -- and believe me, this is not -- maybe it's something I can show. I need something with some weight to it next. How about -- something that won't break the rubber band.

HEARING OFFICER: Something with some weight to it.

A. Just some weight, yeah. It could be -- I don't think my glasses will be enough. My phone might work.

HEARING OFFICER: Your phone will

Page 70

work?
A. Let's see if it will. This is a primitive example, but I just want to give you an idea of... I think it will, if I can get it to hold on while I bounce it around.
This is an unrestricted structure, so this is kind of an upside down house, let's call it. This is the house and this is the ground. So visualize it being upside down. Now, if I keep my hand still, it's going to just wiggle, but if I start to move my hand -- and you see how I'm moving my hand, what's happening. My hand is only moving a very, very small amount, but you notice how much the phone is moving. And I'm moving very slow, and if I move really slow and start to move my hand a lot, it's earthquake motion. That's why the big buildings fall down in an earthquake and the smaller buildings sometimes don't. It depends on what their natural frequency is.
Now, you notice what happens if I move my hand faster. I'm moving it far faster, but the house is no longer moving like it is if I'm moving it slow. That's the frequency. By my hand moving, that particle moving up and down fast, the house doesn't feel that vibration as much as if the particle is moving slow, at a slow frequency. That's the

Page 71

difference between a restrained structure and unrestrained. This is unrestrained.
Now, the pipe in the ground, we can be shaking all around and we aren't going to get it to move any more than the ground is going to move.
Q. So when the vibration hits the pipeline, if it's in the ground, it moved just along with the --
A. It can only move as much as a particle would actually physically move. And like I say, remember that when we talked about this -- these blast effects, where the rock is breaking and where the rock is moving, that's moving. That's physically disruptive. That's what they call the inelastic zone. Inelastic is like this rubber band. Elastic means when I stretch this rubber band it will come back to its normal state. That's the elastic zone. Outside of where we break the rock, that's the elastic zone. That's where particles move and come back to rest.
I hope I'm not going to disrupt. When I banged that table, we saw the table move, we saw this thing move. We didn't see the particles on this table move, but they, in fact, moved. Actually caused that to move more than really what you physically saw the table, again because we actually

Page 72

probably shook the table in the neighborhood of 2 inches per second almost. But I didn't damage the tabletop because the particles were excited and they stopped. I didn't have enough energy -- if I hit this table with a hammer, in that local area where I hit it, if I hit it hard enough, I would damage the formica top, but that's the limit of the damage.
Beyond that we would have just vibration. We would have elastic vibration. We'd have particles moving and coming back to rest. They move some distance but not enough to disrupt the physical part of the table. And that's as best example I can give you with regard to the physical part of the ground. I know it's abstract, but --
Q. I think it was demonstrative.
A. So those are the ways -- those are the four basic ways to describe vibration waves. When I talk about the -- these are just the restrained and restricted structure. That's the buried pipelines. We talked about that.
This is the unrestricted, the houses, towers and bridges. You know, the old -- in the old Roman days, that's how they would destroy a bridge, they would get all the soldiers on the bridge and march in cadence. And they matched the natural

Page 73

frequency of the bridge and it would actually tear the bridge up. They learned from that and made sure that when they go across bridges not everybody walks in the same cadence because they don't match the natural frequency of the bridge. That's because it's unrestrained. It can respond to vibration and match its own frequency by itself.
But a structure in the ground, like a well or a pipeline or a cofferdam, you know, that's below the structure or the ponds there, they can't really move any more than a particle of the ground is. There again, restrained structures are buried pipelines, utilities. They're very resistant to vibration damage because they can't physically move. They are not resistant to blast damage, disruption, if they're in the disruption zone where we break the rock. They're destroyed.
Q. And so by -- what was the phrase you utilized?
A. Disruption zone?
Q. Disruption zone. If you had a charge that was set 30 feet let's say distance away from a pipeline and yet buried let's say 20 feet below, does this disruption zone you speak of create sort of a cratering effect?

A. It will. It will, yeah. I use that in my analysis when I look at my blasting within close vicinity because the vibration damage is much less of a potential than the physical damage from the disruption zone or the inelastic zone where rock is separated and it stays separated. It's damaged and it stays separated. If that area encompasses where the structure is that you're trying to protect, be it a well, be it a pipeline, whatever, it will actually disrupt it. It won't go back to its normal state.

Q. So if the pipeline or the well is in with this crater that you described, it will be within where there is permanent ground displacement that could likely cause harm to the object in the area?

A. More likely to cause harm than the vibration itself.

Q. And how does this relate to blasting at the Magruder site? Will anywhere this pipeline or the sewer plant anywhere be within this cratering zone?

A. No. According to the plan, the Magruder plan, it will be 150 feet from the pipe, the buried pipeline.

Q. And that's the closest it will ever be?

A. At the closest.

Q. And what about the depth of that?

A. That will be -- the elevation of the bottom of the hole will be at the top of the pipeline.

Q. Above it?

A. Above it. So even if it -- if we used what is known as crater theory -- and crater theory is, I think, what Richard was talking about is that if we have a single charge -- and the Bureau of Mines has done thousands of studies, but if a single charge is placed in the middle of a hole here and we don't give it anywhere to go, which is the worst case, it will crater like a bomb dropped on the ground, except that bomb dropped on the ground detonates on the ground and putting it into the ground causes it to be an even bigger crater. And the maximum angle that it will crater out is about 45 degrees. So if a charge is 5 foot deep, you would expect its damage at the surface at the most to be 5 foot because a 45-degree angle is an equilateral -- forms an equilateral triangle, so the base of the height will be the same.

It's like a 45-degree slope, a 1 to 1 slope. So if you had a 20-foot hole, then you would expect the maximum damage to be 20 feet. So if you take the case at Magruder and you remove it -- let me go back to the pipeline. If we go next to the pipeline to do a construction project right next to

the pipeline, if you were at a 20-foot distance from the pipeline and you had a 20-foot hole, you'd have a chance of bringing that pipeline into the damage zone. If you bring that 150 feet away and it was 20 feet -- it would only go 20 feet maximum distance, so you would still have 130 feet.

But that's only when it's below the level. If I bring it above the level, which is the case here, then you bring it completely -- you remove it from the damage zone completely, but at a greater -- and even at a greater distance.

Q. So it's significant to have the bottom of the hole --

A. Very significant.

Q. -- the elevation of the bottom of the hole as it relates to the elevation of the pipelines?

A. In my evaluation, that was a significant factor.

Q. And in this particular case of Magruder, will the elevation at the bottom of the hole always be at the same or above the elevation of the pipeline?

A. That is my understanding, yes. This again -- this is the blasting effect again very -- showing what I was talking about. Here the bore hole

is down below the depth of the buried pipeline, so you can see if I bring that hole closer to the pipeline, the closer I bring it to it and the deeper I make it, the more likely I'm going to have where the blast effects are going to go beyond the circle there that's the blast disruption zone and --

Q. You're ahead of us here just a minute. For the record, are you referring now to Slide 17?

A. I am probably at Slide 21, but it's just because it's a moving slide, but let me go -- start at Slide 18. I'll go back. I apologize.

Q. Is that 18?

A. This is Slide 18, according to my -- the hand-out you gave to me.

Q. And is this reference to what you would describe --

A. Is this 17 or 18? Maybe I'm -- there we go. That's Slide 17, yes.

Q. And is this related to what's described, I think, in the report as ground control?

A. Yes.

Q. And what does that mean?

A. Ground control is the limitation of the disruption zone from the explosive charge. And that will be shown here more in the diagram. Again, this

Page 78

diagram is not to scale. It's just a kind of cartoon to give you an idea of the explosive is loaded in the bore hole. The bore hole depth is deeper than the pipeline. The -- looks like I have little blocks on top of the explosive. That's actually what we call stemming material. That locks the energy of the explosive into the ground. So when the explosive in there is detonated or is initiated, it converts in less than a millisecond to energy. So it goes from solid to gas in a very short amount of time, and the transfer of that energy goes into the rock.

Q. And that's illustrated on Slide 17. That's at the initiation of the --

A. Yeah. And that's --

Q. -- of the blast?

A. Don't forget, we're -- I'm showing the explosives still looking like it's red, but at the very initiation it's gone. It's gone from solid to liquids to gas. And all that pressure is being exerted into the rock. So I have some pictures of some little cracks going out. And those little blue things are kind of the shock wave that's going out into the rock itself. And then I show this blast --

Q. And that would be Slide, what, 19, I believe?

Page 79

A. Slide 19 now I'm on. It's just kind of a step by step. So the vibration waves are those little squiggly lines that are moving out now going into the cushion around the pipeline into the trench of the existing pipeline. And as you see, the extensions of the cracks are starting to form around the hole farther. Now, the -- I just show those vibration waves. The ones on the surface are moving faster than the ones deeper down, and one of them I showed you is kind of squiggling over to the pipeline itself.

Q. And those would be --

A. That's actually the vibration wave traveling through the ground.

Q. And the one at the surface is moving quicker or faster than the ones down in the solid portion, correct?

A. Yeah. It's a phenomena. It's a surface wave. Because it's reached the surface, it tends to go faster than the ones that are in the ground. You get into really details there to talk about that, but basically it kind of shows you what is going on and how the blast disruption zone is expanding.

Then I kind of put these blocks -- these slides are actually from training programs that I

Page 80

give to the pipeline owners and to the engineers with regard to controlling damage to pipe. So I kind of show blocks being moved. What that means is I'm saying if you have a block that actually physically moves into the pipeline or around under the pipeline, it will cause -- that's the most likely chance of damaging that pipeline itself. So we want to minimize that. That's the ground control that we talk about.

We don't want to bring the pipe into any part of the disruption zone. We want to keep it in the elastic zone where the particles are moving and come back to rest.

And then this is just a picture of that -- that I show the pipeline guideline that was adopted by the American Gas Association, and I show 5 inches per second peak particle velocity. The interesting thing on that photo, it's a little small, but the -- in the forefront of us here is actually the trench that's already been blasted and excavated. There's actually a pipeline that's gone across, so they've actually gone under that pipeline with their excavation. And the -- the smoke and everything is actually a blast going off that the middle of us or the trench area is the disruption zone. And you see

Page 81

the gas venting to the sides. You can see from the -- do you mind if I get up and just point to that diagram?

HEARING OFFICER: No. That's fine.

A. It's just interesting because it's a real life photo. This is the pipe that -- this is the pipe that's showing going across, so they had to go under. This happens pretty frequently now that they have to go actually underneath pipelines, so they have to actually excavate on either side and then go underneath that pipeline without damaging it. But this is the open trench that's been blasted. This is the edge of the disruption zone. This is physically you can see how it's broken back a little bit on either side. That's the distance that's been actually physically disrupted. Back here you see the blast going off. This is the disruption zone. The smoke and everything is venting from the edges of the disruption zone.

Q. So for purposes of the record, the silver object crossing perpendicular to the trench is an existing pipeline?

A. Is an existing pipeline that they've had to --

Q. And the top of the photograph is smoke, and

that shows the edge of the trench as it's being blasted as that trench continues?
A. That's correct. It continues for a certain length or distance that they have loaded and drilled. So the vibrations are going all out in these directions when this blast is going off. All right? This is the elastic zone. This is where things are moving and coming back to rest. This is where they are no longer going to be able to come back to where they were.
Q. And that's where they're blasting -- when you're removing the material, that's the permanent ground displacement?
A. Permanent ground displacement. And that's meant to be that way so the excavation equipment, the backhoes and the loaders, can get that rock out and load it off. In this particular photo, I don't know if there's an existing pipeline on site, but if there was, it would be off, you know, on the side here either 20 feet or 50 feet parallel to that trench blast.
Interestingly enough, the 1981 date on the AGA, that is actually a result of the document that you all showed here. They ended up adopting a guideline of 5 inches per second peak particle

velocity based on that report.
Q. And the document you referred to was Applicant's 22?
HEARING OFFICER: Yes, that document is 22.
A. So it is relative. And it's important to understand it's a guideline. It's not saying that if you have greater than 5 inches per second you would damage the pipe. Because if you read through that document, you'll see that there is plenty of instances where they've gone beyond -- like I say, none of that testing in that study or any of the studies actually damaged the pipe. So they have readings that are higher, but they set the guidelines at lower limits for an area of safety.
Q. (By Mr. Brownlee) On all of these empirical studies, do you have -- was the blasting that occurred at the elevation always below the pipelines in these tests?
A. In all the studies, yes, because that's a critical -- I mean, the area they're concerned about is very close -- within 100 feet we say very close -- within 100 feet of an existing buried pipeline.
Q. And it had to be below so there would be room to remove the rock and then place the bedding

material and then the pipeline on top?
A. That's correct.
Q. So inherent to blasting near the pipeline in most cases it would always -- the base of the bore hole would be somewhere below the elevation of the actual existing pipeline?
A. In most cases. In most cases. If there was a hill here and they wanted to put a pipeline next to it, they really wouldn't have to go down to that level. They would just want to bury that pipeline so that it met their specifications.
Q. But if they were side by side, there would always be -- the blasting in these empirical studies would always occur at an elevation below the pipeline?
A. That's correct.
Q. And they were still able to do it successfully at much closer distances than Magruder?
A. They have to in order to complete their project.
Q. Can you kind of summarize your presentation in terms of the -- I think it may be Slide 23, if you want to make reference to that.
A. Yeah. Just to summarize the discussion that we've had and even the studies that have been done,

vibration damage to restrained structures, those that have to move with the ground, will not happen with good blasting design. That means with control of ground disruption or ground control.
In addition to vibration control, a more important factor is the ground control, making sure that the block movement doesn't encompass the pipe or the protected structure. And the best way to protect it is to control that ground disruption. And I don't know if you want to go into that. That's just a summary of -- like I say, how does it relate to the Magruder site is that the plan -- the distance, the minimum distance of 150 feet, well removes it from the disruption zone. Even if the holes are below the level, they're not below the level, so we've actually moved them above that from that elevation.
So aside from being -- if we used the 50 feet depth, Mr. Tichenor, if we used the 50-foot hole, the maximum disruptions, then, would be 50 foot away, so we're actually three times farther, but that's not the case because the hole is elevated above it. But they were all positive factors that I looked at when I evaluated the blast plan.
Q. Relating what you've testified to in terms of pipeline and the blasting below and the

displacement of the ground, the cratering, can you have any conclusions how that relates to the blasting at the pipelines on the Magruder site? And I think there's a slide at 25 that would give you that summary, I believe.

A. 25?

Q. There it is. Or 27. I'm sorry.

A. 27?

HEARING OFFICER: Mine is 25.

A. What happens in the --

Q. (By Mr. Brownlee) I thought it was 25.

A. The thing to remember is that on these slides the top bullet will always be repeated and the second bullet really is the comment to it. So it's to emphasize that -- so I'll go back to 25. You're right in saying... Okay. There's 25. This just kind of summarizes when I reviewed my findings and when I reviewed the blasting plan as was submitted to me for my review. And like I say, the top bullet will always be repeated. It's just saying the blasting is very different from the illustrations that I have had where I'm blasting in very, very close vicinity to buried pipelines and the bore hole depths are lower than the pipelines. So I want to emphasize that based on -- so I use that experience

to evaluate the Magruder site.

So the buried sewer lines at the Lake Ozark quarry will be three to six times greater than the closest at the 150 feet, three to six times that distance that we would be using in a pipeline, that 20 feet distance that I talked about in blasting in pipeline close vicinity, so there's much greater distance. It's outside of the distances that are addressed by the studies of 100 feet. So that eliminates the opportunity for block motion at the sewer line --

Q. And by block motion, your slide had a picture of a block, but would that include, like, a large sharp rock that might be next to the pipeline, too?

A. Yeah, of course it would. I mean, if it's physically disruption of the ground. That's that disruption zone. We've completely removed that from the area. And I guess I show that here in this distance. This is a screen capture just of one of the topo maps, the red being the two forced main lines running along the bottom on the east side. And the blocks again are just representative of blasts -- the initial blasting that would occur on the Magruder permit, as I understand it, in the A sector there.

And there, of course, on the other side of the hill, that's that distance of more than 1,000 feet when the project starts or when the permit starts.

Q. So from the project beginning in the one, two, three, four block areas, it's still then going to be at least 1,000 feet from the red sewer line?

A. Yeah. Yes.

Q. And that's compared to 20 and 30 feet and 50 feet that you have testified to regarding blasting adjacent to direct pipeline?

A. That's correct.

Q. Substantially further away?

A. Yeah. That blue circle there is kind of encompassing the area where my experience would normally be. And then the sewer plant would be up above. I think there probably will be a slide. This is the next -- this is Slide 27, and again the first bullet is just repetition saying that it's very much different than my experience. Why? The grade level at the bottom of the blast holes will be above the elevation of the top of the buried sewer line pipes. Again, this is even more emphasis on the factor of removing it from the disruption zone.

Q. Well, at a minimum of 150 feet, it's never going to be within the disruption zone, is it, sir?

A. No, it is not. It's, again, not to scale, just kind of showing the pipe, the red dot over by the 150 there and the hill over it, again, definitely not to scale with regard to the topography or how the elevation changes.

Q. Okay. And just while we're on that slide, for later reference, you've got the -- on bench one a 50-foot face at the 150-foot distance from the pipeline. Is that what your slide shows?

A. The slide really -- this is the...

Q. Well, where it says the rock nearest the pipeline is last to be blasted?

A. This is the -- again, not to scale here, this is just the 150-foot distance from the pipelines that would be on this side here. This is the bottom of the creek. And what you're indicating is this level here is a 50-foot distance. It was just drawn per the blasting plan.

Q. Is that -- have you learned whether that is, in fact, what it would be at that point of 150 --

A. Since the -- I composed this based on what I saw, and I'm assuming this is March. Since then and after the deposition, I went back and looked at it. At 150-foot distance, this bench height would be --

MR. MAUER: Your Honor, I just want

to lodge an objection to the extent this witness is now testifying about work that has been done after the deposition and that's not in the report and has not been disclosed to us, then I would object to that to the extent that he is now basing new information on stuff not proposed in his report nor presented to us or disclosed to us.

HEARING OFFICER: Well, I'll take it as a continuing objection and I'll hear the testimony, and you can explore it fully on the cross-examination. Proceed, Mr. Brownlee. I didn't -- for the Hearing Officer's understanding, I understood you were inquiring relative to whether or not the elevation of the topography --

MR. BROWNLEE: Was going to end at 50 feet.

HEARING OFFICER: -- was going to end at 50 feet, and I didn't understand that there was a response to that.

A. This was done in March, and I based it specifically on what I read in the blasting plan submitted by Magruder, and they spoke of 50 feet.

Q. (By Mr. Brownlee) For the face?

A. For the faces. And I looked at the worst case situation was 50 feet. But at 150-foot distance

from the pipeline, there's not 50 feet of rock there, it's only 25 feet.

Q. And I think --

A. But I didn't address that. So I addressed it as if there was 50 feet there. So I'm not changing what is shown there. There isn't 50 feet of rock 150 feet away. So the elevation, it doesn't change the bottom elevation of the hole. There just will not be enough to have 50 feet of rock on top of --

Q. So as it slopes -- as the hill or the ridge slopes down to the pipeline, within 150 feet where the blasting would technically stop there just isn't enough rock to get a 50-foot face?

A. That's correct.

Q. And you've looked from the geological as well as the elevation, correct?

A. From the topographic map.

Q. So the 50 foot was an illustration that was probably not --

A. It was my worst case estimate. 50 foot is definitely the largest amount of explosive that we could place in the hole.

Q. And if it's less than 50 feet, it would be less explosive?

A. That's correct.

Q. And that would even have less effect on the pipeline at 150 feet?

A. That's correct.

Q. Why don't you turn to Slide 29, if you would, and --

A. 29, again just repetitious of the first dot, so we're just saying why is it different. There will be more relief faces allowing the fragment rock to move more easily. This is that confinement. In the trench blasting, there is only one face for the rock to move, and that's down the trench. In the case of the quarry blasting, there will be one or two open faces for the rock to move towards, which allows less vibrations to go back into the rock.

Q. Into the hillside, then?

A. Into the hillside.

Q. So the more faces you have -- and if you're just a few feet away, the maximum force blasts the rock out into the open area where it can be picked up and crushed, correct?

A. That's correct. That's the optimization of the blast -- blast effect.

Q. And by the optimization, you use the most force to block the rock away from the face, and that

creates less vibration going back into the hillside?

A. That's correct.

Q. I know a lay person's description, but --

A. And I think the next slide may... Let's see.

Q. 30 would be the next.

A. 30 basically now addresses the blast plan in that when the bench approaches the nearest distance, 150-foot distance, the plan would actually turn the direction of the blast 90 degrees to where they normally would be blasting, which again would help the relief, would then send the vibrations back behind it and not toward the pipeline at all. So I believe that was a positive factor.

Q. I think Dr. Worsey testified to this when you turn the blast.

A. There you go. Here's the slide. Slide 31 shows the normal progression. So the arrows there, the silver arrows -- and this is actually Dr. Worsey's slide -- shows those arrows going back toward the pipeline. And then when they approach the 150-foot zone, you'll see they turn, the four, five, six, seven, eight, nine.

Q. And you're now on Slide 32?

A. Slide 32 shows the 90-degree turn of the

face, so now the direction of the vibrations are directed more in the area of the sequence of production shots next that's on that diagram.

Q. So if you were blasting in block four, the force -- the vibration force would -- a small amount would go towards the pipeline, but most would go towards either block five, six and seven?

A. Yes.

Q. And the face that would blow off would either blow to the right off of the long portion of block four or to the north or the narrower portion of block four?

A. This is to the east, yes, so it would be going to -- the rock movement would be going in this direction.

Q. Towards the east or whatever?

A. This is the east.

Q. Towards the right?

A. This is the north, yeah, and then to the south, this direction. The vibrations would be more going in this direction.

Q. And the vibrations would go back to the left as opposed towards the direction of the pipeline?

A. That's correct.

Q. And is that in compliance or is that in

agreement with what's been proposed in the blast plan?

A. That is what is proposed in the blast plan.

Q. Now if you'll turn to Slide 34, please. And we're getting close here.

A. As part of my analysis, Slide 34 just summarizes. When I approach any type of project, whether it's blasting in a difficult situation or not, I use empirical formulas to make predictions for worst -- what I always use as worst case scenario. That's the only way I operate.

So I looked at the blasting plan that was submitted and took the worst case, 50-foot hole, a dry blast hole. If you noticed in Dr. Worsey's plan, he talked about using an ANFO product which actually amounted to less explosive in the hole, 194 pounds of explosive in what he called the dry hole and then a larger amount, 286 pounds, if that hole had water. And that's just because the ANFO explosive is not water-resistant, so you couldn't put it in a hole full of water. And because the wet hole explosive sinks in water, it has to be heavier, it has to be more pounds in the hole.

So I took those two pieces of information, the pounds of explosives and the distance in this

case from the sewer line, 150 feet minimum sewer line, I took the 50-foot hole depth, which was the worst case that could be there for me, and the calculations came up -- when I say the Dyno Nobel SOP, that's our standard operating procedure.

So as part of our standard operating procedure, our blasters always run a calculation of what the estimated particle velocity will be before they detonate the shot so they have an idea of what it may be. We use a different formula than Lewis Oriard. I use Dr. Oriard's formula in mine, a more conservative formula. As you see, it shows a higher number. It has a higher site constant, so this is a more sophisticated formula than the scale distance formula.

So based on the input information of 194 pounds and 150-foot distance, according to the empirical formula, we'd have 3.6 inches per second peak particle velocity at the pipelines with the Dyno Nobel formula. And then we'd have 5.4 as predicted by Lewis Oriard's formula. With the wet hole, the higher pounds, now we're increasing the pounds, the projected peak particle velocity is 4.9 with the Dyno Nobel SOP formula and 7.4 with the Lewis Oriard formula.

When I assessed it, I look into our comparison. We basically use the Bureau of Mines or the American Gas Association number of 5 inches per second. As long as we're below the 5 inches per second, we're confident that we're not going to place damage on the pipe.

The Lewis Oriard formula, and the way I do my analysis, I utilize the 12 inches per second because that's what Lewis Oriard has done in his studies. You can blast within pipe within 12 inches per second. So in both of these cases it was a lower number than either the 5 inches per second or the 12 inches per second. So I -- I was very comfortable when I made those calculations.

This Slide 35, I don't want to -- it's really an extension of the calculation that was done in the previous slide, but this is in reference to when you measure the velocity of vibration on top of the pipe and on the surface, there's a difference. And I have that note at the bottom there saying in Lewis Oriard's report he had a transfer function, so -- of 2, so the -- based on the pipe cover, the vibration on the pipe would actually be a factor of 2 less than what it was measured on the surface. So that's -- and so you'll notice it's actually a

Page 98

reduction of the numbers in front to 2.7 inches per second and 3.7.

I only used that for his formula because that's the only thing that he relates to. I can't relate it to the Dyno Nobel SOP because we don't have any data to support that. But, again, it shows that at the pipe itself based on the transfer of function developed by Lewis Oriard the vibration would be 2.7 and 3.7.

Q. And how do those figures in either of those calculations you've explained relate to the Bureau of Mines standards about the safety of blasting around pipelines?

A. The Bureau of Mines --

Q. I thought the 4.9.

A. Well, yeah, 4.92 is what they eventually came out. Even though they measured 24 inches per second, their guideline came out to be maximum of 4.92 inches per second.

Q. So in terms of what you've determined -- and this is again way in the future when you're at 150 feet away, as opposed to 1,000 where you're going to start. How do those figures of inches per second relate to --

A. They are less --

Page 99

Q. -- the safety factor?

A. They are less than the Bureau of Mines. And again, remembering that 5 inches per second is not considered to cause damage, just so you understand that. I did the same calculation for the sewage treatment plant using in my case, again, back in March when I looked at it, I did a quick scale of it. I did worst case scenario of 50-foot hole. And where the distance will be 700 feet, I actually used a closer distance of 500 feet. Again, for my analysis, I wanted to use worst case scenario.

Q. Much more conservative approach?

A. Much more conservative. That's how I operate in my analysis.

Q. Now, on both of these you've used a 50-foot hole depth at 150 feet offset. When you looked at the actual geology at the site, did you revise that figure?

A. No. Not for the sewage plant I did not.

Q. Not up to 20 feet?

A. Not at the sewage plant I did not.

Q. Oh, at the plant. I'm sorry.

A. At the sewer pipe I didn't want to mention because Mr. Mauer said that he didn't want me to add any information to --

Page 100

Q. Well, we can -- I mean, I think you've explained. Didn't you explain when you learned that there wasn't 50 feet of rock next to the sewer line?

A. There's 25 feet of rock there. That would reduce --

Q. 25. Did you make a revision just for purposes of this as to what it would be if there was a 25-foot face?

A. I did. For the sewer lines I did. And they were reduced. I'll go back. I don't have a slide for that because I didn't want to make changes of anything that we had presented. But rather than 194 pounds of explosives, you would only be able to place 99 pounds of explosives, of ANFO, and it would be 122 pounds of explosives.

So that would reduce those numbers to rather than -- I'm going to go back, because this is the Oriard. This is the slide we should go back to. It would reduce that 3.6 to a 1.8 inches per second with 25 feet of hole containing 99 pounds. So it changes because the amount of explosive, the pounds, have been changed.

Q. So by essentially having, instead of a 50-foot face as you had originally projected, if you're at 25-foot face, you can only put basically

Page 101

half or less of the amount of powder in?

A. Correct.

Q. And are all of these figures below the 5 inches per second recommended by the Missouri Mine and the American Gas Association?

A. All the numbers that I have shown are below the 5 inches per second per the Dyno Nobel SOP equation, yes.

Q. And what about your personal utilization of 12 inches per second?

A. They are well below the 12 inches per second and having --

Q. Using your own 12 inches per second in your 30 years, have you ever damaged a pipeline?

A. No, sir.

Q. With blasting?

A. No, sir.

Q. As related to vibration?

A. No, sir.

Q. Sir, do you have an opinion regarding just the blasting at the Magruder site on the pipes and the sewer plant?

A. Yeah. And based on a reasonable degree of engineering certainty, in my experience in blasting, the closer you are to the pipeline --

Page 102

HEARING OFFICER: Wait just a moment. Mr. Mauer, your objection?
MR. MAUER: I'm just going to object, your Honor, same objection we made with Dr. Worsey, I think more importantly for this witness, certainly he can testify as an expert to blasting, I understand that, but he's purporting to offer an opinion to a reasonable degree of engineering certainty. There's been no foundation established that he's studied as an engineer, licensed as an engineer, has any certification as an engineer. If you want him to testify based on his blasting experience, I certainly understand that and I'm not objecting, but when he's attempting to qualify his expertise to a reasonable degree of engineering certainty, I don't think there's been foundation laid for that opinion. And that would be my objection. I mean, I think the evidence was clear that he's got a -- basically a BS degree in chemical from New Jersey. I don't think he's --
MR. MIRABELLI: Chemical engineering, sir.
HEARING OFFICER: I believe he is an engineer. He's a chemical engineer. Mr Brownlee, do you wish to respond to the objection?

Page 103

MR. BROWNLEE: Well, I think that's clear he's a chemical engineer, and we're talking about chemical reaction where blasting is involved here. Plus with 30 years of experience, I don't consider that he wouldn't be able to give an opinion based upon his blasting experience and his engineering experience.
MR. MAUER: For the record, your Honor, I'm not saying he can't give an opinion. My objection is simply limited to giving an opinion to a reasonable degree of engineering certainty. Simply because a person is a finance major does not mean they can give an expert opinion as an economist. I mean, I understand he's got his degree, I'm not quarrelling with his experience or his training. I'm simply making an objection for the record about him testifying to a reasonable degree of engineering certainty in qualifying his opinions.
HEARING OFFICER: And just out of curiosity, Mr. Mauer, what would qualify someone to testify before the Land Reclamation Commission to a reasonable degree of engineering certainty? What would they have to possess?
MR. MAUER: A degree and a license and be a licensed practitioner. I mean, simply

Page 104

because someone goes to --
HEARING OFFICER: You've got a statute which would support that?
MR. MAUER: For the Land Reclamation Commission testimony, no, your Honor, I do --
HEARING OFFICER: No. For testimony in general for civil court.
MR. MAUER: I believe we cited case law the last time. I don't have it in front of me. I can get it for you --
HEARING OFFICER: Your case law last time related to a nurse giving a medical opinion?
MR. MAUER: Yes, sir.
HEARING OFFICER: The Hearing Officer after the objection which was raised as to Dr. Worsey has reviewed extensively the Missouri law on engineers and has researched also relative to qualifications necessary to testify, not to practice engineering in the state, and the Hearing Officer has found no basis, statutory rule, regulation or case law which would prevent an individual who otherwise, due to education, training and experience, from offering an opinion and particularly the opinion that this consultant, that this expert witness, is offering.

Page 105

The Hearing Officer referenced because of his personal knowledge at the last hearing the situation concerning licensed appraisers in this state and the fact that the State Tax Commission does have a specific rule concerning that. There is no such rule that the Hearing Officer has found which would prevent a witness with this -- with what has been laid on this record for his training, experience and education from rendering an opinion and testifying within a reasonable degree of engineering certainty, because the engineering certainty we're dealing with in this testimony relates to blasting engineering. So the objection is overruled, and Mr. Brownlee, if you need to restate your question for Mr. Mirabelli, please do so.
MR. BROWNLEE: Well, like I say, we're right at the end.
Q. (By Mr. Brownlee) Based upon the overall mine and blast plan that has been submitted and that you've reviewed, do you have an opinion within a reasonable degree of engineering certainty that the sewer lines and sewer plant are located sufficiently far away as to not be adversely affected?
A. Yes.
Q. And what is that opinion?

A. That opinion based on a reasonable degree of explosive engineering certainty is that the distance provided in the blast plan from the blasting activity to the sewer lines and to the sewer -- sewage plant is sufficient not to affect the operations of the plant, to damage -- adversely affect the plant. Let me put it that way. Adversely affect the plant.
Q. And you've included plant and sewer lines?
A. Sewer lines and the plant, that is correct.
Q. So the opinion goes to both the sewer lines and the plant; is that correct?
A. That's correct.
Q. And regarding monitoring that will occur, what's your understanding of the monitoring that will occur at this location for both the sewer plant and the sewer line?
A. My understanding is that the blast vibrations will be monitored at both the sewer line and at the sewage plant.
Q. What is the significance of that monitoring in terms of your blasting experience?
A. That is an actual measurement of the effects of the blast.
Q. And why is that important?
A. That's important because it tells exactly

what's occurring at the pipeline. It allows the operator, whether it be Magruder or any mining operator, the opportunity to build a history of the reaction of the geology to the blast events at that particular location and allows them the opportunity to make changes to the plan should they need to to better control the effects of blasting at whatever structure the seismograph is placed.
Q. Okay. Finally, based upon your professional training, personal observation, personal experience in blasting, personal observation of the Magruder site, technical knowledge of blasting, your review of the geological maps of the Magruder site, your review of the plans for the sewer pipes and sewer treatment plant, considerations performed reviewing the blast plan, your observation of sewer line locations, your observation of sewer plant location, your knowledge of the material utilized in the construction of the lines, the physical description of the sewer plant and sewer lines, your knowledge of the blasting contractor and knowing the blasting will occur at a minimum of 700 feet from the sewer plant and 150 feet from the sewer lines, do you have an opinion based upon a reasonable degree of engineering certainty whether the Magruder proposed operation at the Lake

Ozark site will have any adverse effect on the sewer pipelines or sewer treatment plant?
A. My --
Q. Do you have an opinion?
A. I do.
Q. And what is that opinion?
A. That none of those activities based on the plan will adversely affect the sewer line or the sewage plant.
Q. And finally, just to lay summary, in your 30 years of blasting experience around pipelines, have you ever seen a pipeline that's been damaged because of blast vibrations?
A. I have not seen a pipeline that has been damaged by blast vibration.
MR. BROWNLEE: Thank you.
HEARING OFFICER: I'm wondering, we've got time before lunch, or we could break early for lunch, come back early and take up cross-examination then or --
MR. BROWNLEE: Do you want to do that?
HEARING OFFICER: Mr. Mauer, if you're ready to go, we can --
MR. MAUER: If I could actually just

have two minutes to run to the restroom, I can do it, and quite honestly, I think I could be done with this witness in certainly no more than an hour, then he can take off. I don't know how much Mr. Duggan has, but -- I can say a half an hour, but then if I go 45 minutes, I've disappointed everyone, or I can say an hour and be a hero.
HEARING OFFICER: Well, let's take a very quick recess and try to come back and wrap up by about 12:15 or 12:30 and take our lunch break then. With that, we are adjourned and off the record.
(Brief recess.)
HEARING OFFICER: All right. We're reconvened. Mr. Mauer, you are recognized for cross-examination of the witness.
MR. MAUER: Thank you, sir.
EXAMINATION
QUESTIONS BY MR. MAUER:
Q. Mr. Mirabelli, my name is Steve Mauer. I'm here on behalf of two of the petitioners, the Joint Sewer Board, Lake Ozark and the City of Osage Beach. Do you understand that?
A. Yes.
MR. BROWNLEE: I'm going to object to his appearance on the part of the City of Osage

Page 110

Beach. They are not a party to this.
HEARING OFFICER: There is standing before the Hearing Officer a motion relative to that. The ruling has not been made at this point. The City of Osage Beach is not a party, not a Petitioner.
MR. BROWNLEE: That was just a technicality. I wanted to make sure the record reflected it.
HEARING OFFICER: I understand.
MR. MAUER: Thank you.
Q. (By Mr. Mauer) Mr. Mirabelli, let me start with your report, the slide show, Page 3. If you have it there, you talked about your services, and I just want to clarify. Page 3. There we go. That bottom bullet about your being available to be retained. You've actually been retained by Magruder to be an expert to come here to this hearing and testify; is that correct?
A. That's right.
Q. And once this hearing is done, the work that you've been hired to do for Magruder is over?
A. Until I'm asked to be.
Q. And at this point in time --
MR. BROWNLEE: Excuse me. You didn't finish your answer. "Until I'm asked to be."

Page 111

A. Until I'm asked to be involved again.
Q. (By Mr. Mauer) So at this point in time everything you've been asked to do, as soon as this hearing is over, you're done. Everything that you've been asked to do will have been completed, correct?
A. I will be -- yes. Until I'm asked to come back and offer whatever other services I can.
Q. So until Magruder decides they want to hire you again, you're done and you have no further ongoing commitment to Magruder or this proposed quarry site, right?
A. That's correct.
Q. So unless Magruder chooses to call you back in, your services will be completed once your testimony is over?
A. I'd say that's correct.
Q. I'm sorry?
A. That's correct.
Q. Thank you. I just couldn't hear you. Now, when you talked about your pipeline construction and your various activities, for example, on Page 7 when you talked about the Texas Eastern Pipeline, now, in that case Texas Eastern owned the existing pipeline, right?
A. That's correct.

Page 112

Q. And Texas Eastern was placing the new pipeline next to its existing line, right?
A. That's correct.
Q. So Texas Eastern as the owner of the existing line and the owner of the new line got to set forth all of the specifications and requirements that it wanted to to protect its existing line, right?
A. Yes.
Q. Okay. And you understand that in this proposed situation Magruder doesn't own the forced main lines crossing the property?
A. That's correct.
Q. All right. And when -- in this situation Texas Eastern made the decision, we need to upgrade or replace our existing line, right?
A. That's correct.
Q. And the property they had to do it in was within the existing easement that they had, correct?
A. That's correct, the right-of-way.
Q. So they called you in because they had a pipeline existing and they had a limited amount of space, and that was going to be a delicate, hard, potentially dangerous project. Is that why they brought in an expert like you?

Page 113

A. That's right. We were brought in by the Sheehan Construction Group to meet with the engineers from Texas Eastern. So we didn't do the physical blasting myself.
Q. I understand. Now, let's be clear. On this situation, you're not testifying that they actually blasted 1,100 miles of pipeline?
A. No, sir.
Q. In fact, a lot of that installation would have been done with typical trenching, not actual blasting; isn't that true?
A. That's correct. If there is no rock to be blasted, there's no reason to blast.
Q. And there is some rock that could be chipped out or dug out in normal excavation procedures rather than having to require blasting; isn't that true?
A. There are types of rock that we can -- or that mechanical excavation can be done, yes.
Q. So in that case with Texas Eastern, you weren't asked to decide, is this excavation or blasting worth the risk of construction next to the pipeline, because, in fact, that was the only place it could go. They only had so much right-of-way easement, and if they're going to build a new pipeline, they've got to put it right there, correct?

Page 114

A. That's correct. That's their decision, that's correct, and that's the decision that will be throughout the country. You can't put pipelines where houses are.
Q. Correct.
A. Right? I mean, the right-of-ways that exist are where the projects have to be.
Q. So you were confined to a limited amount of space. The cost benefit or risk analysis wasn't required because, in fact, that's the only place it can go, so we've got to figure out a way to minimize the risk and blast where we need to because that's where we have to build the pipeline, right?
A. That's the decision of Texas Eastern, yes.
Q. Okay. Now, in this case, in your services for Magruder, were you ever asked to offer an opinion on whether the potential risks to the sewage treatment plant and the sewer line were worth the risk that the treatment plant or the lines might be breached causing an environmental disaster to the Osage River or Lake Ozark? Were you ever asked to make that calculation?
A. No. I was asked to give my expert opinion on the blasting plan and whether those effects from the blasting activity would have an adverse effect on

Page 115

the sewer line or the sewer plant.
Q. All right. You were asked, if we're going to blast on this site, is this plan a safe way to get it done or the best way to minimize the risk to causing a breach in the lines of the sewage treatment plant; is that right?
A. I would say yes, that's correct.
Q. So the risk analysis was already made. You weren't asked to decide, yeah, but, you know, there is still a risk to these lines and, boy, if these lines should breach, we've got a potential for a huge disaster, so it's not worth the risk? You were never asked to offer that opinion; isn't that true?
A. I was asked my opinion of the current blast plan as the blast effects would affect the sewage plant and the sewer lines.
Q. And that is the only opinion you were asked to prepare, correct?
A. Yes.
Q. All right. With respect to Slide 9, which is another one of the pipeline projects, you referenced a study in vesicular basalt; is that right?
A. Vesicular basalt, that's correct.
Q. And that's a type of rock, correct?

Page 116

A. That's correct.
Q. And isn't it true, sir, that you've never done any actual studies on karst geology?
A. That's correct.
Q. On Page 10 of your report you're actually making reference to this unexpected final proof test. Now, unexpected final proof, another way to phrase that is we set up a blast and the blast didn't go off the way we planned, right?
A. The blast was detonated not according to the plan, that's correct.
Q. So you would agree with me that blasts can go off other than exactly as planned?
A. Sure.
Q. You can have mechanical failure, you can have human error, correct? Those both can cause blasts to occur other than as planned, right?
A. That's correct.
Q. And you can also have a variance in rock which could cause a different than the anticipated or expected blast plan?
A. I would assume so. But the important thing is that there was no damage caused by the blast not going as planned. So even though it didn't go according to planned, there was no damage to the

Page 117

pipeline.
Q. But you would agree with me that blasting can cause damage?
A. Blasting can cause damage.
Q. You would agree with me; is that true?
A. That's a statement, yeah. If the blasting occurs in a condition that it -- yes, it can cause damage.
Q. In fact, blasting can cause cracks in a foundation, correct?
A. They can, yes.
Q. On Page 11, I just want to make sure I've got this straight, the specifications that you were testifying to for the current project is a PPV of 5 inches per second, right?
A. That is correct.
Q. And so in this study, the carefully controlled construction blasting is actually going to have and require a PPV of only 5 inches per second?
A. A maximum PPV, according to the specification, that's correct.
Q. Okay. And, again, for the 200 miles, you're not saying that you're actually going to blast a pipeline each mile of that 200 miles?
A. No. That's not realistic. There's not --

Page 118

you know, if there's rock that distance of 200 miles they would, but it depends on the geology and what they run into, sir.
Q. And is it also true that throughout that project the blaster would have to evaluate each blast based upon the rock that they see on site as they set up to do that blast?
A. Would you say that again, Mr. Mauer?
Q. If you're blasting at one spot and then you move down the pipeline and you set up the blast in another spot, is the blaster going to be able and going to want to be able to adjust the blast based upon what the blaster sees at that site at that time?
A. He would have that option to do that. He has the blast plan that has been tested when they start, but if the blast plan addresses -- I don't know the exact number here, but if the blast plan addresses 10 feet of rock in the trench and there's only 8 feet of rock in the trench, then he has to make an adjustment.
Q. So, in fact, the best blast plan, even if it was the most detailed plan you could ever create, you'd still want to have the flexibility to be able to adjust it as the blasting occurs based upon the conditions that exist at the time; is that true?

Page 119

A. That's true, but you would always do your calculations based on the worst case. So if there's not -- if there's 10 feet of rock, if the most there's going to be is 10 feet of rock, that's the worst case scenario. If there's 8 feet of rock and he makes his adjustment, the only adjustment he can make is to reduce the amount of explosives in the hole since there's not enough room there. So you do have that address. Yes, they can make changes, but if you address the worst case scenarios, then the situation of the change is not something that can affect the pipeline.
Q. Okay. Let me ask you this: The blast plan that was prepared for this portion of the quarry site, is it detailed enough and specific enough, in your opinion, that you could say, so long as every detail of that blast plan is followed exactly the way it is written, the quarry can continue -- the quarry could operate?
A. I think that the way the plan is written it is such a simple plan, it is not a complicated plan, that based on the worst case scenarios, if there was a 50-foot bench and there was 40-something feet of explosives placed in there that there is more than enough safety factor in the plan that the pipes will

Page 120

not be affected or the sewage plant would not be affected.
Q. Let me try it this way: Dr. Worsey told us that built into the plan is the ability to modify it based upon what is seen in the field. Would you agree with that, that that's part of the plan?
A. That is my -- that's a part of every plan is that it can be changed. It can be modified.
Q. On Page 17 and Page 18 you have a depiction of the shot, right?
A. Yes.
Q. Now, your depiction there doesn't include any rock strata, correct?
A. That's correct.
Q. Now, isn't it true, Mr. Mirabelli, that the impact of the vibration might be different if there is rock strata running through that shot?
A. Yes.
Q. So that if there is rock strata, the vibration will travel differently than it will through the same piece of solid rock, correct?
A. Yes. Yes.
Q. All right. Now I have another question for you. If you could turn to Page, oh, call it 19. I was confused by something. If I understood your

Page 121

testimony, you said that rock travels faster -- I mean, I'm sorry -- vibrations travel faster through rock than soil; is that right?
A. I did say that, yes.
Q. Okay. And then when rock hits -- when the vibration hits the fill, it actually slows down as compared to traveling straight through the rock, right?
A. There is a reduction in its speed, yes.
Q. And if I understood your testimony, because of that analysis, that actually was better for protecting the pipes because it's not -- the vibration coming through the rock is reduced or slowed by the fill material before it gets to the pipe, right?
A. It changes a -- there's a density change or a medium change between two materials, be it the rock, the soil and even the soil and the steel pipe or the plastic pipe.
Q. So is my understanding correct that the -- having the fill material around the pipe would change the vibration and lessen the impact on the pipe?
A. Say that again.
Q. Would having fill material around the pipe rather than just laying right up against rock, would

Page 122

that help slow the vibrations or change the vibrations such that it is better for the pipe?
A. It's a benefit, yes. There is a benefit provided by fill material.
Q. Okay. Then that was -- that's what I understood. Then I was confused, because I thought back on your testimony for Mr. Brownlee you testified that fill doesn't matter.
A. It is not as important a factor.
Q. But it does have an impact whether the fill is there or not, correct?
A. It does have an impact, but it really does not matter as to even the quality of the fill, as long as it's a change in material. But the effect is not as much as putting the pipe and the explosive in the disruptive zone.
Q. Well, certainly. I understand that.
A. All right. I'm just...
Q. If you blast within the disruptive zone of the pipe, you're going to shatter the pipe, right?
A. Yeah.
Q. All I'm simply asking is, I understood your testimony to be that bedding doesn't matter, fill doesn't matter, cover doesn't matter, but, in fact, when you were discussing this situation, in fact, the

Page 123

amount of fill and the type of fill could have an impact on the pipe and the vibrations, true?
A. It could have an impact, yes.
Q. Thank you.
A. It's the degree of the impact, I think, is what needs to be considered.
Q. Now, is it your testimony that the kind of pipe is all going to react the same so that the type of pipe is irrelevant?
A. No. Again, it's let's say relative to a factor. The type of the pipe in the conditions that we are, 150 feet away, is really irrelevant to it. The pipe is different, I understand that. Pipes are made of different material, they have different pressure ratings. When you're in close vicinity, as per the discussions in the study, they indicate the differences in the Young's modulus in the pipes, the pressure ratings of the pipes, the wall thicknesses, et cetera, but at a distance beyond 100 feet, the fact of that really becomes irrelevant.
Q. I'll talk about the 150 feet in a second, but I want to make sure we're clear. It is not your testimony that the kind of pipe is just irrelevant?
A. That is correct.
Q. Okay.

Page 124

A. Not completely irrelevant. It is more of a fact when you're in close vicinity.
Q. Sure. The closer you get to the blast, the bigger the impact on the pipe, the more important the type of pipe is going to be?
A. Very much so.
Q. And is it also true that the more important -- it's also going to be important to know the type of joint structure that is used for the pipe?
A. Yes.
Q. Is it also important, then, to know the condition of the pipe, whether or not it has deteriorated, disintegrated or if it's new pipe?
A. That's a factor, particularly when you're in close vicinity to the pipe.
Q. In fact, in your Eastern pipe -- your East Texas pipeline explanation, that pipe was being replaced because it had corroded, right?
A. No. It was weakening. It wasn't corroded. They were still providing service with that pipe.
Q. Thank you. But it was weakening, and they decided, this pipe is of a condition that it needs to be replaced, right?
A. It was aging. I don't know about the

Page 125

weakening, sir. It was definitely aged.
Q. You would agree with me that pipe that's in the ground for awhile could have had impacts and stresses on it that would be different than brand new pipe laid in the ground?
A. I don't think I could testify to that.
Q. Because you're not a pipe expert, right?
A. I am not a pipe expert, and I didn't proclaim that I was, sir.
Q. Thank you. Now, when you talk on Page -- this Picture 19, when you have your blast rupture zone and going to the right away from the pipe, I assume that's where the rock is going to break off and fall off into the pit, right, or into the quarry?
A. This is not a quarry depiction. This is a trench blasting next to a -- this is a pipeline construction drawing.
Q. Okay. So this isn't even --
A. And I haven't extended the cracks this way only because in my presentation -- this is a presentation I make for training. I don't really account for the cracks going the other way. They're there, but I just showed them going towards this because that's where we're trying to control the ground.

Page 126

Q. So Slides 17, 18, 19, 20 and 21 all relate to a construction blast designed to be near an existing pipeline?
A. That's correct.
Q. Okay. Now, in the blast plan, you're not proposing that Magruder come in and blast a trench parallel to the sewage treatment lines to create a gap or barrier protection trench between the proposed initial blast site and the pipeline; is that true?
A. No, sir. I did not say anything to that point.
Q. That's not part of the blast plan, right?
A. No, sir.
Q. On Page 23, when you talked about vibration damage to pipelines, isn't it true that you said true vibration damage is extremely rare? Right?
A. (Nods.)
Q. That's what it says, right?
A. Yeah. That's one of my training slides, as a matter of fact.
Q. So would you agree with me that even though it is extremely rare, vibration damage to a pipeline can occur?
A. It may. It is so rare that I don't have an example. That's why I put that I don't have an

Page 127

example to give it.
Q. Sure. Isn't it also true, though, that proving that blasting actually caused damage is very difficult to prove?
A. I mean, proving that anything caused damage is difficult to prove.
Q. Because, in fact, there are other considerations that could be blamed for a rupture to a pipeline, such as settlement or ground heaving, freeze, thaw, all sorts of other things that could be blamed for a pipeline to be damaged; is that right?
A. I would say so. When a pipeline breaks in my home, there's usually some reason for why it broke. There's no blasting going on around my home.
Q. And so you would agree with me that pipeline damage, even if there's blasting near it, is still difficult to prove that it was actually caused by the blasting?
A. Any damage is difficult to prove, sir.
Q. Now, on Page 24, you're talking about the sewage treatment plant to the north, right?
A. General to the north, yes.
Q. All right. Now, and when you look at Slide 26, you can skip there if you like, the blast plan and your review all related to this initial quarry

Page 128

area A, correct?
A. That's correct.
Q. All right. So you didn't analyze the potential impact of blasting on the sewage treatment plant if, say, the quarry is now mining on the east side of the sewage treatment plant where your little inset says, "Approximate area of mining," correct? If the quarry's over there, you didn't analyze that impact; isn't that true?
A. Can you point out to me where you're speaking? I'm looking at A, B and C or somewhere else?
Q. I'm talking about if you were -- if the quarry was operating over here in this area immediately to the east of the sewage treatment plant, you didn't analyze the blasting and the potential impact on the sewage treatment plant over here?
A. Not in March I didn't, that's for sure, sir.
Q. Okay.
A. I did analyze from B, though. The worst case scenario was not in A but in B at a 700-foot distance from the sewage plant.
Q. And did you physically measure that site B to the edge of the sewage treatment plant?

Page 129

A. No, I didn't. If you recall in my calculations, I actually used a 500-foot distance for that because I did not actually measure it. So rather than 700 feet I used -- that's only because I am conservative on my calculations.
Q. Did you physically measure the 500 feet?
A. I measured them on the map by scales.
Q. And did you measure at all the distance from the sewage treatment plant to the Magruder mine site to the east?
A. No, sir.
Q. Okay.
A. I visually saw it, but I did not physically measure it.
Q. On Page 25, if you can just back me up one slide, the 150 feet, that is what was set forth in the proposed mine plan, right?
A. That's correct.
Q. Have you reviewed the application submitted by Magruder for a quarry permit?
A. No, I did not.
Q. Are you aware of any requirements in the application itself that would limit Magruder to the 150 feet?
A. No, sir.

Page 130

Q. Are you aware of any Missouri rule or regulation that would require Magruder to stay 150 feet away from the pipelines or the sewage treatment plant?
A. I am not aware, sir.
Q. Do you know if, in fact, the 150 feet would be completely voluntary by Magruder?
A. What do you mean by voluntary?
Q. That they would stay 150 feet away only because they choose to rather than being required to by some provision in their application?
A. I don't know if I could answer that. I mean, it's my understanding they were going to stay 150 feet. Whether that's voluntary or restricted wasn't a factor in my decision.
Q. You were just asked to assume that they're going to stay at least 150 feet away?
A. I was asked to evaluate the mining plan with the blasting activities proposed in it, yes, sir.
Q. And that mine plan assumes that there's a 150-foot buffer?
A. Yes.
Q. And that 150-foot buffer, as we see on Page 26, that is simply for your analysis of the mine plan set on that -- I think it was designated as plan A,

Page 131

right?
A. Say that again, Mr. Mauer.
Q. Your 150-foot buffer relates to the mine plan, and the mine plan evaluates quarrying on the space marked A, correct?
A. A and B also.
Q. All right.
A. The distance was -- my understanding was all along the length of the sewer line.
Q. And so at this point in time, Magruder hasn't asked you to devise a plan that would protect the sewer line or the sewage treatment plant when they go on any other area beyond A and B?
A. C.
Q. A, B and C?
A. Yeah. C was included. C was on this drawing. This is the way I received the mine map back in March.
Q. So other than A, B and C, you haven't been asked to review any sort of plan or offer any opinions or assist Magruder in any way to protect the sewer lines or the sewage treatment plant beyond A, B and C?
A. They've talked to me about it, but we haven't really -- we didn't do it in the

Page 132

presentation, that's for sure, because it wasn't addressed earlier.
Q. And it's not addressed in the mine plan that you reviewed, right?
A. No. No.
Q. That is correct?
A. This is what I've placed in my presentation. This is what I reviewed.
Q. And on Page 27, I just want to be sure, you talked about the elevation. Again, are you aware of any specification in the application that would limit Magruder's ability to quarry at an elevation only above the elevation of the sewer lines?
A. No. Not -- I didn't review the permit, so I don't -- no. I just know what I was told, that they were going to do it to that elevation, and the reason I was given was with regard to the water situation, which made sense to me.
Q. When you turn to Page 31 of your opinions, Page 31, this shows the initial shots there on -- or blasts for proposed quarry site A or B, right?
A. Yes. This is a slide from Dr. Worsey's presentation, actually, which was the plan that I had reviewed.
Q. So this is Dr. Worsey's slide?

Page 133

A. This is his slide, yes, that's correct.
Q. And so the next slide, 32, is that his slide also?
A. I believe it is.
Q. Okay. Now, do you see the space to the right of number four going away from five?
A. Here?
Q. Yeah, right there. Do you know what that is?
A. That would be where a blast had occurred.
Q. Do you know what his plan was to how that was going to get there?
A. No, I don't at this time. I mean, it's not...
Q. If you look at Slide 34, in Slide 34, just so I'm clear, you are using Dr. or Mr. Oriard's formula. There the calculations are above the 5 -- PPV of 5 inches per second, correct?
A. That's correct. 5.4.
Q. Now, on Page 36, again, that's where you've assumed a 500-foot offset from the blast boundary, right?
A. Yes.
Q. And do you have -- have you seen anything in writing anywhere where Magruder has committed that it

Page 134

will stay 500 feet away from the sewage treatment plant east boundary?
A. You keep asking me about that east boundary, and I've told you what I reviewed.
Q. And I just want to make sure, have you seen anything in writing anywhere where Magruder committed or told you even that they would stay 500 feet away from the sewage treatment plant on the east boundary?
A. No, sir.
Q. Page 37. Your opinions -- and I'm just clear that you're basing your opinions on the mine blast plan submitted, right?
A. Yes, sir.
Q. And the mine blast plan, as we look back on Page 26, relates to that first plan blast areas A, B and C, right?
A. Yes, sir.
Q. So you're not offering opinions on any blast plan for the east side of the sewage treatment lines, the east side of the sewage treatment plant, you haven't done any sort of opinions on all the remainder of that proposed quarry site; is that correct?
A. Correct. I mean, I could have been asked that, but I wasn't at that point asked that.

Page 135

Q. If you look to the -- I guess it's the second to last page. There we go. I want to ask you about that word, the second to the bottom line, "Blast will further ensure that pipeline is not compromised." Do you see that?
A. Uh-huh.
Q. Is your opinion a guarantee that there is absolutely no way that the quarry activities or blasting could ever cause damage to those two forced mains crossing the Magruder property?
A. I don't know if I like the word guarantee. I think I told you that in the deposition. I don't know if I could guarantee anything, but I believe in my -- as I stated in my opinion, that the distances and the charge weights, that we would not affect it. And this statement of "further ensures," I think it's even an added measure, there's even an added measure of protection by doing that measurement. That's a plus.
Q. I appreciate that, but I think I heard you say that you would not guarantee; is that right?
A. I don't like the word guarantee. From a layman's term I guess I would guarantee it, but I don't know from your legal viewpoint, I don't know what you're saying guarantee to me, but...

Page 136

Q. Would your opinions guarantee that the operation of the quarry, including when it goes to the east of the sewage treatment plant, would never have an adverse impact on the sewage treatment plant?
A. I thought I said I didn't do anything on the east. I mean, if I was, if you asked me if I could give an opinion on the east side, I could, yes.
Q. But you haven't been asked to do that. You haven't been asked to review a plan, right?
A. You're asking. I haven't seen a plan to do that, that's correct.
Q. So there's no way you could say that if this permit is granted there could never be any damage to the sewage treatment plant based on quarrying on the east side, correct?
A. That's correct. I wasn't asked to -- if they were to ask me to do that, I could prepare a position.
Q. When the vibration is moving through the ground on your slide where you did -- you've now explained it was actually a pipeline trench shot from your training sessions. Okay? Remember that slide?
A. Yeah.
Q. When the vibration is going through the rock, and then you testified when it hits soil or

Page 137

fill it's going to be a different vibration, right?
A. Yes.
Q. What happens to that vibration if it hits a void and it goes right through to empty space?
A. It actually slows down.
Q. So it would actually -- so an empty space would actually -- again it would change the dynamics?
A. It's a discontinuity, yeah. It's a discontinuity.
Q. And would the impact be different and change if it hit a void filled with water?
A. Yes.
Q. When you said that the rock -- that the soil would move and vibrate but it would come back to rest, would it move and come back to the same place because there's something pressing against it that all it can do is vibrate?
A. It's elastic. Yeah. It's a very difficult thing to describe, but yes, it comes back to place because it's not -- it's in the elastic zone. It's not physically displaced. It's not broken like the rock that's in the disruption zone. I don't know how else to describe that to you.
Q. Well, when you do a quarry shot and you break off the face, right, now, first of all, that

Page 138

rock disruption in breaking off, it's designed to do two things, isn't it, at least?
A. Yeah. It's going to do four things, right?
Q. Well, it's going to separate the rock and fracture it, right?
A. It's going to break the rock.
Q. And it's also -- isn't the shot also designed to break the rock into a bunch of little pieces so that it can be crushed easier than one great big slab?
A. Yes. Fragments. That's what I mean by fragmentation. So it's break, fragment and move the rock.
Q. And when that rock moves, it falls away because there's nothing there on the other side of the face, right? The force hits the rock and it pushes it off because there's nothing there against it?
A. It has relief, what I call relief, yes.
Q. Now, if there is a void on the other side in the rock and there's particles of dirt laying up against -- just resting against that void, when the vibration hits it, would those particles -- would those pieces of dirt tumble into the void, just like the free face of the rock falls off?

Page 139

A. Explain to me where the void is, where this -- where is the void?
Q. Can you go back to your slide?
A. Yeah. Are we going back to the trench blast or are we going back to the --
Q. 17 is fine. That's fine. Either one of those is fine. Now, as I understand it -- I want you to assume for me that actually this shot is more like a rock quarry shot and going to the right, away from the pipeline. You're going to break off a face of rock and fragment it so it can be quarried. Okay?
A. Uh-huh.
Q. Is that okay?
A. Okay.
Q. All right. Now, assume for me that going the other way, all right, beneath the pipeline, for example, is a void. There is a -- the ground has settled beneath the pipeline, there's actually empty space there. Now, when a particle of dirt laying up in that void, when it hits with that vibration, would it tumble into the void as compared to just vibrating and resting to the same spot, if there's nothing up against it on the other side of the vibration, just like the free face of the rock?
A. Depending on the distance, it could, but the

Page 140

pipeline is not going to be near the blast holes at Magruder.
Q. I understand that, but the answer to my question is, under the right circumstances it could happen; is that right?
A. Under the right circumstances, if there was a void -- an empty space, you're saying?
Q. Yes, sir.
A. That had soil next to it, dirt next to it or even rock next to it, let's say, and it was within the blast disruption zone, material could move into that void, yes.
Q. Okay. Thank you. Would you agree with me, sir, that equally important for the blast plan is the implementation of the plan?
A. Yes.
Q. And this is your first opportunity to work with Magruder; is that right?
A. I think I testified to that, that's correct. My personal first.
Q. And so have you reviewed any of Magruder's personnel protocol, the qualifications of any of their personnel, to know the ability of the Magruder personnel to implement the blast plan?
A. No. My understanding was that Dyno Nobel

Page 141

personnel were going to be doing the blasting.
Q. And have you seen any contract between Dyno Nobel and Magruder that would confirm that, in fact, Magruder has hired Dyno Nobel for that work?
A. No. That's not my responsibility. That wasn't even something I looked for.
Q. Are you aware of anything in the blast plan that requires Dyno Nobel to do the blasting?
A. No, sir, but I think by Missouri law it would have to be a licensed blaster, so -- in Missouri. They just couldn't do it right without someone, so we would have a licensed blaster.
Q. Yes. If Dyno Nobel is chosen to do the work, Dyno Nobel would have a licensed blaster, right?
A. That's correct.
Q. Have you done anything to analyze the ability of any licensed blaster employed by Magruder to implement this blast plan?
A. No. I wasn't asked to do that, sir.
Q. You talked about you weren't -- you didn't actually go into the sewage treatment plant. Did you actually go to the front door and ask anybody if you could go inside and take a tour?
A. No. The gate was locked when I was there,

Page 142

and it said authorized personnel only and I didn't go beyond the gate, Mr. Mauer.
Q. You didn't actually go into the office or knock on the door and ask somebody to take you for a tour?
A. No. I didn't know whether it was manned. There was a truck out there, a pickup truck, but I don't know...
Q. So you didn't try?
A. No, I didn't try.
Q. And did you ever contact anybody from the City of Osage Beach or the City of Lake Ozark asking permission to go in and take a tour?
A. I didn't think I had to go just down the road there and ask just to take a look.
Q. I mean inside the plant.
A. No.
Q. And you may have been asked this, because I think you testified ductile iron is softer than steel pipe; is that right?
A. I called it -- I called it softer. I mean, from a relative standpoint. The strength of it, as I said -- and as you said, I am not a pipe expert, but I am a chemical engineer, so I am familiar with strengths of pipe. That is less than the welded pipe

Page 143

that's used on a transmission line which is probably maybe twice as strong from a PSI standpoint. But that was the limit of my -- I guess my explanation.
Q. Are you aware of any Missouri agency that regulates blast plans?
A. I am not aware of a -- I don't think it's required by permit. I know that.
Q. Are you aware of any agency that monitors blast plans to be sure of compliance?
A. I am not aware in Missouri.
Q. Are you aware of any penalties for failing to follow a blast plan?
A. In the state of Missouri?
Q. Yes, sir.
A. No, not -- I'm sorry. I'm not in the state of Missouri. I could give you other states that I would say yes, but...
Q. And isn't it true, sir, that your previous projects, your prior works, have not included blasting near a sewage treatment facility?
A. They may have, but not something particularly addressed as such. I'm sure there was something around, but not something...
Q. You never had a situation where you were blasting so close that you could look over and see

Page 144

the sewage treatment plant?
A. Right, that they called me to come in and do that. I mean, that's... No. No.
Q. With respect to -- I also believe you testified about some of your training for MSHA; is that right?
A. Mine Safety and Health Administration.
Q. Are you aware of the requirements and all the various rules and regulations adopted by MSHA?
A. I'm aware of a good part of them, I would say. I know where to reference them, sir.
Q. And are you aware of whether a blasting -- what happens if a mining company doesn't comply with the requirements of MSHA?
A. There are fines issued.
Q. Have you done anything to analyze whether or not Magruder has been fined or cited by MSHA?
A. No, sir, I do not. I do not.
Q. Have you done anything to analyze or evaluate whether Magruder's ever been cited by the DNR?
A. It wasn't something that I was asked to do, no, sir.
MR. MAUER: I'm almost done, Mr. Tichenor. I'm going to keep to my hour, I promise.

Page 145

Q. (By Mr. Mauer) Let me show you what's been marked as Board Petitioner's Exhibit 27. Board Petitioner's Exhibit 27 is a listing of an inspection at the Ashley quarry which is operated by the Magruder Limestone Company. Do you see that?
A. I see Ashley Quarry, Warren B. Magruder. Yes, I do see that.
Q. And do you see that, for example, on the first page of Exhibit 27 it shows that on 12/4/2007 they were -- Magruder was cited for a MSHA violation? It's at the very bottom of the first page, right there.
A. Oh, the first page?
Q. The very first date. Do you see it?
A. Citation number -- that says one? Is that what you mean?
Q. Yes.
A. Okay. I see one there. It says number of citations, it says one.
Q. And when you look below that on May 8th, 2001, MSHA issued two citations to --
MR. BROWNLEE: Your Honor, I'm going to object to the relevance. We've been over these MSHA violations, and I think you ruled only NOV's issued by. And, in fact, there's no background or

Page 146

basis to this, and I think it's totally irrelevant. And further, it's not anything that was even raised on direct.

MR. MAUER: Well, my cross is not limited to items raised on direct.

HEARING OFFICER: I understand that, Mr. Mauer. Are you prepared at this point in time -- we'll just limit it to the two citations which you have referenced -- to put before the Land Reclamation Commission a foundation to establish that these violations directly related to blasting?

MR. MAUER: No, sir. That's not what I'm offering them for.

HEARING OFFICER: What are you offering them for?

MR. MAUER: I am offering these MSHA violations as evidence to show whether Magruder as a company has the quality controls and the internal capabilities of complying with basic safety statutes, which would be important, we believe, for the Land Rec Commission's decision on whether or not Magruder would have the capabilities to actually comply with the blast plan. It's not going to show that it is an NOV violation; it's going to show --

HEARING OFFICER: Well, Mr. Mauer, it

Page 147

can't come into the record because by rule and regulation when we're dealing with non-compliance, we are restricted as to those acts of non-compliance.

MR. MAUER: I understand.

HEARING OFFICER: These are not acts of non-compliance that come under the rule and regulation.

MR. MAUER: Can I just make an offer, then, for the record? All I want to do is I want to offer for the record BP-27, 28, 29, 30 and 31 and 32 which would, we believe, be evidence not to show that Magruder is a habitual offender which would be a reason for not issuing the permit but rather be evidence of whether Magruder would be capable or could be trusted with complying with specific limitations which may or may not be placed by the Land Rec Commission on this permit, including compliance with a blast plan and any assurance that they will comply with anything in the future for a plan that's not even been developed yet when they get to those portions of the proposed quarry site. And that's the limit of my offer. And I'm not offering them to --

HEARING OFFICER: 27, 28, 29, 30, 31 and 32 have been offered. Objection has been made.

Page 148

Objection has been sustained. Exhibits are not received into evidence. Any further questions of the witness?

MR. MAUER: One last thing.

Q. (By Mr. Mauer) On page 25, your very bottom line there says, "This would eliminate the opportunity for block motion at the sewer line location." Okay? I want to ask about the word eliminate. Is it your testimony and opinion that there is absolutely no possibility of any sort of breach or damage to the sewage treatment lines that run through the Magruder limestone quarry?

A. At the 150-foot distance, no, sir.

MR. MAUER: Thank you.

HEARING OFFICER: Conclude your cross-examination, Mr. Mauer?

MR. MAUER: Yes.

HEARING OFFICER: All right. Thank you. Mr. Duggan, cross-examination?

MR. DUGGAN: I have just a few questions that are intended to clarify.

EXAMINATION

QUESTIONS BY MR. DUGGAN:

Q. I represent the Land Reclamation Program's Director, and he is the one who has recommended the

Page 149

issuance of the permit, but his recommendation is capable of being overturned by the recommendation of the Hearing Officer based on health, safety and livelihood being unduly impacted by the permit being issued. Okay?

A. Okay.

Q. So I'm just trying to make sure I understand your testimony so that it's clear to the Commission. In looking at your series of slides, Numbers 17 and forward to about 23, I believe -- 21, you use these for training purposes; is that right?

A. That's correct.

Q. And I just want to understand, the picture of the pipe itself, the buried pipeline, is that intended to depict a pipe that has some sort of bedding material around it?

A. Yes. The black part is what they would call padding or you might call bedding for the pipeline, and the green would be the fill material and padding on the outside of the -- between the pipe and the actual rock trench.

Q. And what about the green area? Is that a void or --

A. I thought I said that. The green in the middle, that's fill.

Page 150

Q. That's also fill?
A. That's fill material, yes.
Q. On the slide as shown on the screen there, there's black underneath, but there's also green.
A. The black is kind of my representation of the padding. When I talked with them, like I said, they're very, very restrictive on their specifications for the amount of padding. That's how we determine how much of the ditch we have to blast for the construction of the new pipe.
Q. Oh, I see. Okay.
A. So you have -- when they give you the specification that they need, they tell you that you need to have 3 foot of cover, the pipe might be 42 inches in diameter and they mandate another foot of padding. So we have to make sure, so that's why I've got that depicted there.
Q. Now, if you jump over to Slide Number 21, which shows a shifting of rock being pushed into the pipe.
A. Yeah. That's a --
Q. I just want to make sure I understand. Does that assume the rock penetrates the bedding material and hits the pipe?
A. Yeah. It's an exaggerated picture, but it's

Page 151

demonstrating block movement. I actually put, like, concrete blocks in there just because of the graphics on the computer, but yes. So you can see it would have to move a pretty far distance, you know, at least a distance through the padding, push through the padding to get to the pipe.
Q. Could it -- would you also say it could depict a pipe that has no padding around it, it's resting up against rock between --
A. It could if, again, that rock wall -- that end of the trench there was in the blast zone, yes, the disruption zone.
Q. Now, when you talk about the worst case scenario being the basis of your analysis, did you look at all at the specifications for this particular pipeline?
A. I looked at the specifications, I think as I mentioned, were provided to me, you know, with the 3-foot minimum cover and -- that's what I looked at, yes.
Q. Okay. Now --
A. I don't know how they were as-built, though.
Q. Right. Well, let's assume that as-built there is, in fact, pipe laying up against rock without some padding or very thin padding. Would

Page 152

that in any way affect your opinion about the 150-foot set-back distance?
A. Are you saying that if the rock -- that's the way it is right now, just like we show there, there's a piece of rock that's touching the side of the pipe?
Q. Right. Right.
A. No. No, sir, it would not.
Q. And that's -- I wanted to make sure I understood that, because in your opinion that 150-foot distance is adequate no matter how the pipe was installed; is that right?
A. That's correct. Because we are above the elevation and at that distance.
Q. Okay. Now, turning to the end of your opinion report, I believe we looked at Slide Number 37 which summarizes your opinions. I'm not sure we looked at Slide 38, which as I see it is some qualifications of the opinions on Slide 37. Is that a fair statement?
A. Yeah. This was written again in March. I put this together in March. And that is why my statement was clear saying not closer than 150 feet. Is that what you're asking?
Q. Yes. Why would you not recommend a blast

Page 153

closer than 150 feet, I assume based on this blast plan?
A. Only because when I looked at it I was only evaluating it at that distance, so I was kind of quantifying my evaluations. And if I evaluate at 150 feet, I don't see a problem at 150 feet. If I was asked -- since that was already prepared. I think in deposition someone had asked me if I could -- if I would blast closer. I indicated that I would because there's such a factor of -- safety factor, I'll call it, of distance at 150 feet. Remember what I'm saying, with it being elevation higher, we actually have 150 feet? We probably could come closer. But I wasn't asked to evaluate that.
Q. Right. So your next point underneath there says you could probably come closer than 150 feet, but I assume that you would require a modification of the blast design before picking a different distance than 150 feet?
A. I would want to do -- remember, I only made my calculations to 150, so if you were to ask me to do that, I'd go back, redo my peak particle velocities and make sure that they still stay within my guidelines as well as the Bureau of Mine's guidelines and then make a decision as to whether it

can go as-is or there should be a recommended change.
Q. And this is Dr. Worsey's plan; is that right?
A. Yeah. I simply reviewed the plan that was built by Dr. Worsey and, I think, Keith Henderson with Dyno Nobel, another -- the local representation here in Missouri. I'm in addition to the Dyno Nobel group that works with Magruder.
Q. Now, you weren't asked to come up with your own blast plan, but I assume you could if you --
A. Oh, yeah, I could have. I was asked to review -- give my opinion of the current blast plan that was presented.
Q. Of the existing plan?
A. So that's how I made all that, you know.
Q. Dr. Worsey indicated that his selection of 150 feet was based on the lack of economic value to getting any closer than 150 feet, as I recall his testimony. In other words, there's not enough rock there to make it worthwhile. Did you take a look at that aspect at all?
A. I really didn't until maybe Dean asked me to look at the elevation, you know, was I sure that there was rock at 150-foot distance, and that's where we came up with this 25 foot -- there would only be

25 foot at 150 feet, so the economics would drop off once you moved closer. Since I walked that site, I'm sure that the terrain is always going down toward the pipeline and toward the creek.
Q. And if I understand your testimony, if they wanted to get closer than 150 feet, they could modify this plan to allow them to do that, if they wanted to get at that smaller amount of rock; is that right?
A. Yes, they could, if they thought there would be a value to getting that. It would be less than 25 feet, so --
Q. But they would have to reduce the amount of explosives being used?
A. To physically fit in the ground, yes.
Q. So at this point, based on the work you've been asked to do, do you have any opinion at all as to the absolute minimum distance or set-back that this -- that Magruder can have at the site? Or is that too hypothetical for you?
A. It's pretty hypothetical. I mean, if you used a 100-foot distance, if you basically used -- special precautions need to be taken once you get to 100 feet. You still would have elevation to your advantage, so there might be some, but I'd want to run numbers to make sure and make sure the explosive

charges were correct. It's really general.
Q. That's what I was getting at. You would want to do a new analysis based on the new factors presented to you in a modification of the plan?
A. That's correct.
Q. I'm just curious, with respect to your chemical engineering degree, did you take courses that involved explosives?
A. I had thermodynamics and, you know, chemistry courses that involved explosives, but I didn't take college courses in explosives. There are few colleges that have a curriculum that covers explosives, Dr. Worsey's being one of them. There's a few mining schools that do that, but -- but I have been asked to go and talk on campuses and speak on explosives.
Q. And you consider yourself an explosives engineer?
A. That would be my best characterization of my -- I'm a chemical engineer with experience in -- all my experience, really, in the field of explosives.
Q. Okay. And when you talk about the field of engineering in general, in order to qualify the type of engineer one is, one looks at both the educational

background and the experiential background; isn't that right?
A. Yes.
MR. DUGGAN: I don't have any other questions.
HEARING OFFICER: Mr. Brownlee, you move for the admission of Applicant's 9 and 22 at this time?
MR. BROWNLEE: Yes.
HEARING OFFICER: They are offered. Any objection, Mr. Mauer?
MR. MAUER: No objection.
HEARING OFFICER: No objection. Applicant's 9 and 22 are received into evidence. Before I ask if there's any redirect, the Hearing Officer has one question.

EXAMINATION

QUESTIONS BY HEARING OFFICER:
Q. The 5-inch-per-second PPV is the standard set by the U.S. Bureau of Mines?
A. It's a recommendation by the U.S. --
Q. A recommendation. And that is the same under Dyno Nobel's standard operating procedure?
A. Yes. That is what our operators use, work with, yes, sir.

Q. And under the Oriard's study, a 12-inch-per-second PPV equates to the 5?
A. It does if you look at the two equations side by side, Mr. Tichenor, because that's exactly what they are, the same inputs with -- it's a different equation. I could show you the equation differences, but Lewis Oriard's empirical formula is more restrictive than the Dyno Nobel SOP and the one that's used in the DuPont Blaster's Handbook. So they do -- the answer, I guess, would be they are pretty close. I'd have to -- I could run those calculations for you.
Q. I just -- that was my understanding from looking at the calculations and from your testimony. I simply wanted --
A. To make sure you understood that. Yeah.
HEARING OFFICER: All right. Mr. Brownlee, did you have any redirect or do you have any redirect of this witness?
MR. BROWNLEE: Just a follow-up.
EXAMINATION
QUESTIONS BY MR. BROWNLEE:
Q. The question that the judge just asked you, those are the peak particle velocity recommended for blasting around pipelines, correct?

A. Yes, sir. Yes, sir.
Q. And it's a separate figure that's also reflected in the Missouri law for structure -- uncontrolled structures?
A. For uncontrolled structures are subject to the Z curve.
Q. Right. Thank you.
MR. BROWNLEE: That's it.
MR. MAUER: Nothing further.
HEARING OFFICER: Nothing further? Then we've concluded the testimony of this witness. Mr. Mirabelli, I thank you for your testimony, and you are excused. We will adjourn until -- do we need a full hour?
MR. BROWNLEE: Yeah.
HEARING OFFICER: All right. We'll adjourn until 1:45. We need to be back to get started then. We have Applicant's last witness, I assume, and that's all we're looking at doing today. Friday, then, we are taking Mr. Dressler and any rebuttal.
MR. BROWNLEE: Correct.
HEARING OFFICER: And so we're going to finish with Mr. Henderson today, folks, whether it's 5:00 or whatever, we're finishing with

Mr. Henderson today. All right. With that, we're adjourned. Off the record.
(Luncheon recess.)
HEARING OFFICER: The hearing will come to order. Mr. Brownlee, you may call your next witness.
MR. BROWNLEE: Keith Henderson.
HEARING OFFICER: Mr. Henderson, will you come forward to be sworn.
KEITH HENDERSON,
of lawful age, produced, sworn, and examined on behalf of the Applicant, deposes and says:
HEARING OFFICER: Have a seat in the witness chair. Do we need to get a copy of the report to the witness?
MR. HENDERSON: I have the slide presentation.
HEARING OFFICER: Okay. You don't want a paper one to work off of?
MR. HENDERSON: No. I'll just go off these.
HEARING OFFICER: Okay. Proceed.
EXAMINATION
QUESTIONS BY MR. BROWNLEE:
Q. Please state your name.

A. Keith Henderson.
Q. What is your date of birth?
A. 7/31/1968.
Q. And describe your education beginning with your graduation from high school.
A. I hold an Associates of Arts degree in general studies from East Central Community College and I have a Bachelor of Science degree in economics from Southwest Missouri State University.
Q. And have you taken any post-graduate degrees in engineering at all?
A. No.
Q. Are you a registered professional engineer under any state licensing?
A. No.
Q. By whom are you currently employed?
A. Dyno Nobel.
Q. And would you explain the business of Dyno Nobel?
A. Dyno Nobel is a manufacturer and distributor of commercial explosive products to the mining industry and construction industry, as well as seismic and other portions of commercial explosives consumption.
Q. And what countries does Dyno Nobel operate

Page 162

in?
A. Currently we operate in North America and Australia are our primary locations, and due to some recent acquisitions, there's re-introduction into eastern Europe and other parts of the world as well.
Q. Are you one of the largest what I would say blasting and blasting contractors and suppliers in the world?
A. Yes, we would be one of the larger ones. We're the largest one in North America.
Q. What is your current position?
A. I am the technical sales manager for the Midwest area.
Q. And what area is the Midwest area?
A. The Midwest area encompasses from Wisconsin over to Minnesota down to Texas and all states in between, including Illinois, Iowa, Kansas, Oklahoma and Arkansas.
Q. And what are your current duties as technical sales manager for the Midwest region?
A. I have primary responsibilities to our wholly owned subsidiary offices in making sure that our blasters receive the training put forth by the company, and also I provide appraisals of our blasters twice a year. And beyond that I also answer

Page 163

any product complaint that may come up. And I also work in conjunction with consulting with quarry and construction work on development of blast designs for their operations and also... I'm trying to think off the top of my head. Oh, I also respond to concerns from nearby neighbors if there's a concern with blasting. Most generally I or the person that's directly under my supervision handles or responds to those calls initially, and we respond and also work with the quarries in relation to those concerns as well.
Q. Do you do any post -- pre-blasting inspections?
A. Well, we don't do pre-blasting inspections, but I do perform risk assessments for the company, and those risk assessments are basically a determination of the site, the location of where blasting will take place in relation to other surrounding structures or other surrounding utilities, anything along that line. So basically it encompasses what the quarry would possess and own on their property, any off-site structures and also take into consideration any utilities, whether buried or overhead.
Q. Briefly describe your blasting -- or your

Page 164

employment history.
A. I started in January of '92 with Dyno Nobel. At the time it was a little subsidiary, wholly owned subsidiary under the official name of Econex. I was a blaster in training. And from there I went -- stayed with Dyno Nobel through January of 1993 -- or right around January, February 1993, right in that area. There was a small time where I was working then in the insurance industry up until August of '93, and then I went to work with a joint venture in August of '93 by the name of Dyna Blast in western Kentucky. And in December of '93 I was asked to open our site located down in Scott City, Missouri, and from December of '93 until 2000 I was basically the blaster and the sales representative for that office until I took this position in 2000 as the technical sales manager.
Q. And how long, actually putting the dates together, how long have you had personal experience in blasting?
A. About 16 years.
Q. And have you during that period had personal experience blasting or consulting projects near or adjacent to buried utilities?
A. Yes. I personally have blasted on a few

Page 165

occasions next to buried utilities myself, and we actually have several locations where we blast where there's buried utilities and overhead utilities as well.
Q. And when you say "we," I assume you're addressing Dyno Nobel?
A. Yes. I'm sorry. Dyno Nobel, yes.
Q. There's been -- the phrase has been utilized construction blasting. Are you familiar with that phrase in the industry?
A. Yes.
Q. And could you explain to the Judge what that is, in your understanding again?
A. Well, construction blasting typically falls under blasting that is primarily for development work. Typically the rock is not going to be reused for anything. Typically it's also used in a little more closer proximity to structures and other utilities, as you'd see in urban developments, for instance, where they have to blast in close to buildings in order for -- whether it be for foundation prep work or things along those lines.
Q. How would you compare it to quarry production blasting?
A. Well, it depends on the quarry. For the

Page 166

most part quarry blasting is a little bit different in the fact that it's an open bench blasting. Most quarries are typically located in pretty rural areas; however, of course, with the expansion of a lot of urban areas out further reaching into areas they once -- you know, residences once were not, now it's not uncommon at all to have quarries surrounded by homes or other businesses or anything along that line.

Q. For example, you said that quarries have been surrounded by homes or businesses. Is there an example here in Jefferson City that we all might be able to allude to?

A. Yes. Capital Quarry's Stadium location is surrounded by several commercial businesses, and there's also homes basically to the west of the quarry and, well, pretty much all around the quarry as well.

Q. Are you going to address that site a little later, I assume?

A. Yes.

Q. And have you had any personal experience in blasting near a sewer plant?

A. Yes. Actually, there was one blast in particular that I did about 2,000 feet from a sewer

Page 167

plant. It was a unique blast in the fact that they -- Lone Star Industries was collapsing a series of their old underground mines, and I initiated the blast down there, and that consisted of about 145,000 pounds of explosives.

Q. Was there a delay in that, or was it a single shot?

A. They were delayed time, as most of our -- well, as all of our blasts are.

Q. How big of an area did this blasting include in terms of knocking those tunnels out?

A. The actual total surface area I don't know off the top of my head, but it was a -- it encompassed about 360,000 ton of rock, roughly, is the amount in the blast.

Q. And where was that located?

A. That was located in Cape Girardeau, Missouri.

Q. And was the rock ever utilized or did they -- what was the result of the blasting?

A. Yes, the rock was excavated for use in production of cement, Portland cement, but that is made at Lone Star.

Q. Are you now a licensed blaster in the state of Missouri?

Page 168

A. I possess an MLPA blaster certification which under the Missouri Blasting Safety Act that was adopted last year would allow me to grandfather in and receive a blaster's license upon application and review of my current certificate.

Q. Are you a member of any professional associations or professional societies that relate to your experience in blasting?

A. Yes. I'm a member of the International Society of Explosives Engineers. I currently am on a committee there for public education and public relations. I'm also a member of the local chapter of the Mississippi Valley International Society of Explosives Engineers. I'm a current board member, a past president and a past vice-president of that organization. I'm an associate member of the Missouri Limestone Producers Association and also an associate member of the Illinois Association of Aggregate Producers.

Q. And do you hold any offices in relation to Missouri blasting law?

A. Yes. I serve on the Blasting Safety Board for the State of Missouri, and I'm currently the chairman of the Board.

Q. And that was the new law that was enacted

Page 169

last year, you're president of the Missouri Blasting Safety Board?

A. Yes. Officially listed as the chairman of the Missouri Blasting Safety Board.

Q. What are the duties of the Board? And I realize they're in the statute, but just briefly describe, if you could.

A. The primary responsibility of the Board is to help the Fire Marshal in promulgation of the rules in the Act as it is written and also to advise the Fire Marshal in areas that they may need education or help in in regards to blasting in the state of Missouri.

Q. Has the Board promulgated any rules or worked in the drafting of any rules at this point?

A. The first initial promulgation of the rules began earlier this spring. There has been one meeting since to approve those rules, and the rules have been submitted to the Secretary of State for publication.

Q. How many members are on this Board?

A. There are six members on the Board.

Q. And how are they selected?

A. They're selected by the Governor, and then they have to receive Senate approval, then, for their

Page 170

appointment.
Q. And are members of the Board representative of various phases of the industry?
A. Yes. There has to be two representatives from explosives manufacturing, there has to be one representative from the vibration industry. There has to be one representative from the construction industry, one representative from quarry industry and then also one representative that is the Fire Marshal's designee that represents a local or county municipality dealing with blasting regulations.
Q. And when were you elected as chairman?
A. I don't recall the exact date. It was this spring, basically, or late winter.
Q. And related to the Blasting Safety Board or your employment with Dyno, do you teach any blasting courses?
A. Well, I have a number of courses that I am authorized within Dyno Nobel to provide for our blasters. One is our blasting safety training, which is an eight-hour course specifically just on blasting safety. The other one is our introduction to open pit blasting or also referred to as our open pit blasting one and two, which is a preparatory course to go on our advanced open pit blasting which is a

Page 171

40-hour training course, and that is another one that I'm also asked to train as well. And then I have some various other ones, such as bulk explosives and bulk delivery systems that I --
Q. You use the word bulk. What does that refer to?
A. Bulk explosives are explosives that are delivered by the process of a mechanical means, typically a bulk truck. For instance, auger trucks are used to deliver dry ANFO, and then you have pump trucks that can actually pump a pumpable explosive into the ground.
Q. Are sticks of dynamite still used in blasting?
A. Dynamite is still used. In fact, we're the last manufacturer of dynamite in the country. But it's very uncommon and rare for -- just for purposes of ease and convenience and partly because of cost, too, because dynamite is typically much more expensive as far as explosives go. But the most common blasting agent used in the industry right now is ANFO, which is ammonium nitrate and a fuel oil combination.
Q. And is that a dry product when we talk about blasting, dry holes with ANFO?

Page 172

A. Yes, it's used only in dry holes. ANFO is hygroscopic. It actually absorbs water and will draw water to itself, so as such we have to use it in dry bore holes, otherwise it will just basically dissolve and lose its ability to perform.
Q. What about is there a corresponding explosive you utilize for what you would term as wet holes?
A. Yes. We use what we call a repumpable emulsion. An emulsion is simply an ammonium nitrate based product that also contains fuel oil or mineral oil in it, and it has an emulsifier that actually keeps the salt phase or the ammonium nitrate phase of the product mixed in with the fuel oil so that it won't separate and come apart from each other.
Q. Do you have any responsibilities under the MLPA certification program?
A. Yes. I serve as a guest lecturer for the MLPA voluntary certification program. Basically I assist in certain sections. Geological considerations on blasting is one of the sections, and the other section is in regards to loading of blast holes.
HEARING OFFICER: Mr. Brownlee, just for my record, let's get what MLPA --

Page 173

MR. BROWNLEE: I was going to get there.
HEARING OFFICER: I'm sorry. Great minds run the same direction.
Q. (By Mr. Brownlee) We use the phrase MLPA. Could you explain for the record what that is?
A. Yes. MLPA stands for the Missouri Limestone Producers Association.
Q. And prior to the Missouri Safety Act, how did that organization relate to the certification of blasters?
A. The MLPA offered a voluntary certification program in conjunction with the University of Missouri Rolla, and basically it was a program to design -- to help give blasters uniform training throughout the state on basic use and practices of explosives, safe handling and use of explosives.
Q. So prior to the Missouri Blasting Safety Act being enacted, was that the licensure provision that we've heard discussed about a person being a licensed blaster?
A. In the state of Missouri, that's all at that time that was available was a voluntary certification.
Q. And have you provided any training for other

Page 174

independent distributors and blast contractors?
A. Yes. I'm repeatedly asked to train, usually along the lines of blasting safety training, sometimes basic blasting design and application. And I also do guest lecturing on the Kansas State blasting course as well.
Q. I'm going to hand you I believe what's been previously marked as BP-43, which is the Missouri Blasting Safety Act.
MR. BROWNLEE: Did you find it, your Honor?
HEARING OFFICER: I have a different copy, actually, but I'll go off BP-43, yes.
MR. BROWNLEE: Well, we'll make reference to any statutory sections we're referring to.
Q. (By Mr. Brownlee) What, in your view, Mr. Henderson, is the purpose of this act?
A. Well, the Act was designed to ensure that there was uniform training standards and licensing procedures for blasters in the state of Missouri.
Q. Does the Act set any limits regarding the ground vibrations for uncontrolled structures, such as the sewer plant?
A. Yes. It sets forth in the Act basically --

Page 175

Q. Make reference to the statute, if you would.
A. Make reference to the statute?
Q. Yeah.
A. It would be Section 319.312. "Ground vibration limits to be followed when alternative compliant method limit on acoustic values from blasting." It says, "Any person using explosives in the state of Missouri in which monitoring with a seismograph is required, as provided in Section 319.309, shall comply with ground vibration limits based on the U.S. Bureau of Mines Report of Investigations 8507, Appendix B."
Q. And what are those ground vibration limits? And you can -- I mean, I know you could refer to them, but...
A. It's a curve, basically, because structures respond at different frequencies, therefore the limit is at 2 inches per second higher frequencies, and at lower frequencies that limit drops down to as low as 5 inches per second. And that is criteria that is based on the study 8507 that was done by the U.S. Bureau of Mines that basically established that level is the safe level for the weakest materials, such as plaster and drywall.
Q. Now, does the Act make a differentiation

Page 176

between what I think we've used the word controlled structures versus uncontrolled structures?
A. Yes. They actually have in the definition a listing of what an uncontrolled structure is.
Q. And where is that located?
A. That is located in Section 319.303 under definitions, Paragraph 25.
Q. Okay. And what is -- I know the Act speaks for itself. Can you read that definition under (25), please?
A. Yes. "Uncontrolled structure. Any dwelling, public building, school, church, commercial building or institutional building that is not owned or leased by the person using explosives or otherwise under the direct contractual responsibility of the person using explosives."
Q. Do you see, is the word pipeline mentioned in the definition of an uncontrolled structure?
A. No, it is not.
Q. And what would a controlled structure be? Although not defined in the law but by definition, what would the controlled structure be?
A. The controlled structure would be anything that is basically owned by the mine itself.
Q. For example, a weight house on the project?

Page 177

A. Yes.
Q. A blast?
A. A blast house and the scales, those sort of things would belong to the mine, therefore they'd be under the mine's control.
Q. Do you know why the definition of an uncontrolled structure does not include pipelines?
A. Well, the pipelines are more resilient to blasting vibrations, and as such the definition doesn't include pipelines because the RI 8507 standards deal with structure response from structures such as buildings and so forth and does not include pipelines, so the same standard was not observed within the Act.
Q. When the Missouri Blasting Safety Act was enacted, did you have any direct input into the drafting of that act?
A. Through the Mississippi Valley SE, you know, I gave my input, just as many others did within the chapter and my opinion as far as regarding what was in the Act.
Q. Do you know during the adaption of the Missouri Blasting Safety Act whether at one time the bill had a definition including pipelines and water wells or underground utilities?

Page 178

A. To my knowledge, there was, in an earlier draft of the legislation, there was pipelines included in that listing.
Q. I'm going to hand you what we've asked the court reporter to mark Applicant's Exhibit 24.
HEARING OFFICER: Do we not have a 23?
MR. TROUTWINE: No.
MR. BROWNLEE: We skipped it.
HEARING OFFICER: So we're moving to 24. That's all right. I just didn't want to miss anything. All right. This is Applicant's 24. Applicant's 24 is a copy of Senate Bill 882 as introduced.
Q. (By Mr. Brownlee) Take a look, if you would, at that point. It would be Subparagraph 26 on Page 4.
A. Okay.
Q. And without reading it, again, could you direct the Judge's attention to whether underground pipelines or water wells are defined there as an uncontrolled structure?
A. Yes. It's noted on Line 89, Paragraph 26, "Underground pipeline or water well that is not owned or leased by the person using explosives."

Page 179

Q. And during the process that this bill was considered, were those definitions removed?
MR. MAUER: I'm sorry, your Honor. Lack of foundation that this witness would know. The adopted statute speaks for itself.
MR. BROWNLEE: Well, I'll do it this way:
HEARING OFFICER: Hearing Officer will take official notice. They were removed somehow.
Q. (By Mr. Brownlee) Well, make reference to the final Act. Are the words underground pipelines or -- excuse me. Are the words underground pipeline or water wells included in the final definition that's now the Missouri law?
A. No, they are not.
Q. So they were somewhere during the legislative process removed from the definition?
A. As far as evidenced by what is presented, yes.
Q. Can you explain the ground vibration limits imposed by the Missouri Blasting Safety Act, in particular Section 319.309?
A. You would like me to read that entire section?

Page 180

Q. Well, let's see if we can cut through this, because it does speak for itself.
A. Okay.
Q. In Section 1 it refers to blast distance; is that correct?
A. Yes, that's correct.
Q. Now, is this section -- again, it deals with uncontrolled structures, correct?
A. That is correct.
Q. And under Magruder's site, what would be the uncontrolled structure that this bill would -- that the Missouri law would address?
A. In relation to the initial site, which is -- has been referred to before as site A -- and I have that in part of my presentation -- the nearest uncontrolled structure would be the sewer treatment facility.
Q. And, again, we've testified earlier that the underground pipelines on the site are not specifically addressed in the Missouri statute, correct?
A. That's correct. It's not covered.
Q. And is there a reason from the blasting standpoint that they wouldn't be?
A. Well, again, pipelines themselves are far

Page 181

more resilient to ground vibrations, and the reason is because of their buried nature. They move in conjunction as the ground moves to, whereas a structure such as a home or in this case the sewer treatment plant actually has movement independent of the ground. So as a result they can actually -- those particular structures can actually create an amplification, if you will, of the ground vibrations.
Q. And, again, please reference Section 319.309, Section 1, where it discusses "The person using explosives shall calculate the blast distance to the nearest uncontrolled structure." And in this case the sewer plant. Could you explain what the scale distance that they refer to means?
A. What blast distance itself means?
Q. Yes.
A. Blast distance is simply a relationship between the linear distance to the structure compared to the amount of explosives that are going to be shot off within any given 8 millisecond delay.
Q. So it's a formula that utilizes, what, two factors?
A. Two --
Q. The amount of the explosives and the distance from the ignition site to the uncontrolled

Page 182

structure?
A. That's correct. The distance from the blast site itself is in consideration, as well as the amount of explosives that will be detonated within an 8 millisecond delay period.
Q. And where did the factor 55 come from?
A. Well, to read directly from the first paragraph, it says, "Any person using explosives in the state of Missouri shall calculate the blast distance to the nearest uncontrolled structure. If more than one uncontrolled structure is the same approximate distance from the blast site, then the person using the explosives may select one representative structure for calculation of the blast distance."
And then in Paragraph 3 it goes on to state that, "In any instance when the blast distance value is 55 or less, any person using explosives except provided in Section 319.321 shall use at least one seismograph calibrated to the manufacturer's standard for use to record the ground vibration and acoustic levels that occur from the use of such explosives or explosives material."
Q. So on this particular Magruder site, if the blast distance from the site of the blast to the

Page 183

sewer plant is less than 55, would we utilize a seismograph?
A. Yes. As was reported in the blast plan, the intention is to use seismographs at all times, at all locations. It's actually part of Dyno Nobel's standard operating procedure to use -- and place seismographs at every blast, regardless of the distance to the nearest structure.
Q. So if you're utilizing a seismograph in the blasts at this location in terms of the blasting as related to the sewer plant, you don't even have to compute blast distance under Missouri law; is that correct?
A. That's correct. Paragraph 4 states that "Any person using explosives who is voluntarily using a seismograph calibrated to the manufacturer's standard for use for all blasting is exempt from the requirements of this section."
Q. Is that a tacit recognition that if you're using a seismograph, that exact knowledge is much more significant than the approximation contained in the blast distance?
MR. MAUER: I'm sorry, your Honor, calls for speculation and a legal conclusion. The statute speaks for itself. I'm not sure what tacit

Page 184

admission by who.
HEARING OFFICER: I'm a little bit concerned about that also. I don't know whether the statute can tacitly admit. Do you want to take another stab at it, Mr. Brownlee? I think you're basically just trying to get the witness to declare what the statute says.
MR. BROWNLEE: Well, yeah.
Q. (By Mr. Brownlee) I mean, if you use a seismograph, you don't have to use blast distance; is that correct?
A. Yes.
Q. And that's on any blast in the state?
A. Yes, that's correct. The purpose -- and that's one of the reasons that it's part of our standard operating procedures is that we want to know exactly what the ground is doing. We don't want to draw conclusions only on calculated values. We would rather know what the ground, in fact, actually has in relation to ground vibrations.
Q. And the ratio that's created -- if you did use a blast distance, it compares the size of the blast to the distance; is that correct?
A. Well, it compares the amount of explosives per 8 millisecond delay to the distance. So if --

Page 185

if, for instance, you design a blast such that it will fire what we refer to as one hole per delay, meaning that only one hole is going to go off within any 8 millisecond given time period as delay timed out, then we would base the pounds per delay on the number of pounds in one hole, and then you'd use that number to help determine the blast distance.
Q. And on the Magruder site, in particular the sewer plant, do you know what the blast distance -- have you computed that under the blast plan?
MR. MAUER: I'm sorry. Objection, your Honor. Which part of the Magruder site?
MR. BROWNLEE: Where the blasting will initiate under section -- portion A.
MR. MAUER: Thank you.
MR. BROWNLEE: I'm sorry. That's what we...
A. I have computed it, but I don't have it directly in memory, committed to memory.
Q. (By Mr. Brownlee) Do you know whether -- how it relates to the 55 figure?
A. To my knowledge, it's actually over 55, to my knowledge.
Q. So --
A. I would rather recalculate it, though, to be

Page 186

able to tell you for certain.
Q. But if it's over 55, in that case under Missouri law you still wouldn't even have to use a seismograph?
A. That's correct, but we'll use the seismograph regardless.
Q. Anyway, okay.
A. I mean, that's just a given. We just will not do blasting without seismic information.
Q. And the pipeline you said is not covered under the Act, correct?
A. Yes, that's correct.
Q. Now, by not being covered, it's not specifically mentioned?
A. That's correct.
Q. But does it anywhere else in the Missouri Pipeline Act or the appendices deal with a situation that might be considered as a pipeline?
A. Not to my knowledge, it's not in there anywhere.
Q. And does Dyno always blast under a blast distance of 55?
A. Well, I wouldn't say we always blast under blast distance of 55, but needless to say we shoot in close proximity in a lot of locations, and so a blast

Page 187

distance of 55 is not a -- again, it's not something we necessarily are overly concerned about because we're going to use actual seismic data to let us know how our blasts have been, and we use that information for future blasts as well.
Q. So as the blast distance decreases, is that indicative of a ratio of a larger blast at a closer location?
A. Well, just to give you an idea why blast distance was created, the idea of a blast distance was to give some kind of correlation between what would happen if I produced a really large shot at a large distance, how would that compare to a blast that's at a much closer distance or ratio to a structure or building but I'm using a smaller charge, how would the two be compared. And so it's just kind of a comparative number, if you will.
Q. Are there any blast distance concerns at the Magruder site for the sewer plant?
MR. MAUER: I'm sorry. Again, your Honor, which part? Are we talking about anyplace on the site or this one starting spot?
MR. BROWNLEE: The part that will be for the first ten years, A, B, C, not year 99. And I would assume the questions I'm asking have that

Page 188

assumption. I'm sorry.
HEARING OFFICER: All right. With the understanding that you're referring to the sites which are designated A, B and C of the blast plan.
MR. BROWNLEE: Or the bonded sites on the project.
MR. MAUER: Well, all right. Now I need to clarify, because the bonded sites extend to the east of the lines --
HEARING OFFICER: Bonded sites, Mr. Mauer, are further out than A, B and C, so if we're talking about the closest point under A, B and C, the additional bonded sites are further out, so the information being elicited would cover that.
Q. (By Mr. Brownlee) Are there any blast distance concerns at issue at the Magruder site from any blasting that might occur in section A, B and C on the blast plan?
A. Well, again, it would be hard to specify because those areas cover a large area, so -- but as we -- for instance, in section C we may actually get closer to a residence, and whether or not it complies -- or it has that blast distance 55 criteria, again that's going to be irrelevant in the fact because we're going to be using a seismograph on

Page 189

each time. So therefore the actual blast distance computation is something that's not even required. Again, you know, it's in the Act that you don't even have to compute blast distance if you're going to be using a seismograph.
Q. From your experience in blasting, how are pipelines damaged by blasting?
A. Pipelines are damaged in regard to the information I've reviewed when the pipeline itself is actually either in the crater zone or actual material has been shoved into the pipeline from the blast. So, in other words, it's usually indicative of damage that has occurred from very close-in blasting. And there has been no information that I'm privy to at all where vibration concerns have been the cause of pipeline failure.
Q. Due to blasting?
A. Due to blasting.
Q. Have you previously worked with the Magruder company?
A. Yes.
Q. And how long and where has Magruder worked with you or Dyno before?
A. Well, Magruder's been a customer of Dyno Nobel for as long as I've been employed, so I'm not

Page 190

sure how far back it extends before then. And my actual involvement and interaction with them would have taken place after I took this position as technical sales manager, because then my territory that I covered was much larger by that time, so it actually encompassed where they do work at, then.
Q. Regarding the work that your company has been asked to perform at this site, what services were you asked to provide Magruder?
A. For the Lake Ozark site?
Q. Yes.
A. In particular the services we were asked to provide would be blasting for that particular location, blasting services.
Q. And did that consider specifically the consideration of the sewer plant and the underground pipelines?
A. Yes. Actually, when -- you know, if the permit is granted, we will actually do a risk assessment, even though that's similar to what I've already compiled by testifying, in the fact that we will actually -- I will actually submit that risk assessment to several other people within our company. And the reason is because, quite frankly, we don't want to take -- on the blast the size of a

Page 191

quarry -- this is a relatively small quarry. It's relatively low revenue for us, and as a company it just doesn't make economic sense for us to enter into blasting something that could possibly generate a significant loss compared to a little amount of revenue generated.
Q. And you drafted, I believe, a report for the presentation in this case; is that correct?
A. That is correct.
Q. And what materials did you review?
A. First of all, I reviewed the blast plan as submitted by Dr. Worsey and Mr. McDonald. I also reviewed various aerial maps, topo maps. There was a geological map that indicated the rock type. And in further relation I reviewed a U.S. Bureau of Mines Report of Investigations of 9523, as well as a paper, a preliminary paper, on the exact same study that they presented at the International Society of Explosives Engineers regarding vibrations and pressurized pipelines. And also then referred to a book by Lewis Oriard in relation to vibration and blasting and also the International Society of Explosives Engineers Blasting Handbook.
Q. And the treatises that you referred to, are those typical things you rely on as Dyno Nobel when

Page 192

you consider blasting at a site where there might be an issue such as a pipeline or a structure?
A. Those are fairly typical. And beyond that I even employed our empirical numbers and different empirical numbers that are accepted in the industry to ensure that the blast plan would match those standards that are accepted throughout as proper burdens and spacings and blast designs, parameters.
Q. Did you also review information and drawings supplied through discovery by the Joint Sewer Board?
A. Yes. I reviewed the information that was submitted.
Q. And just can you quickly summarize what that stuff -- what you did review?
A. I reviewed -- there were some construction cross sections, I guess, if you will, on the pipelines themselves and then information as well on the sewer treatment plant also that I reviewed and information, for instance, on a particular -- I guess there was one particular part of the pipe, the mega flange, that was included in there as well.
Q. And did you do any site visits?
A. Yes. I made two site visits to the Magruder property. One was with Mr. McDonald and Dr. Worsey to look at the feasibility of the blasting that was

Page 193

their preparation for the blast plan itself. And also then I was in communication with Mr. McDonald and Dr. Worsey in regards to the actual blast plan that was drawn up as far as, you know, if I would have had any objections or concerns, to put forth those concerns at that time.
And then there was one additional visit I made when there was a preliminary hearing at -- I believe it was at Osage Beach, and then the hearing moved out to the -- up to the site, and we walked over the site as well as parked at one point down by the sewer treatment facility and then walked up the easement.
Q. I think that would have been the January visit that we --
A. Yes.
Q. -- many of us attended.
A. Yes.
Q. Are you a trained geologist?
A. No.
Q. During your 16 years of blasting, have you been -- had occasion to blast in what's been discussed as karst topography?
A. Well, there's various karst topography around the state, and I have blasted in and near

Page 194

karst topography before, yes.
Q. In viewing the site, have you seen any signs of any karst topography on this location?
A. Again recognizing that I'm not an expert geologist, but I did reference specifics, since the reference to Ha Ha Tonka State Park came up, I went to the Missouri Department of Natural Resources's website. They had a reference on there as typical features of karst topographies, including such things as natural bridges, sink holes, streams that basically have no outlet that basically drop down into the ground and caves and the like. I haven't seen that there are any such features on this property.
Q. Did you have any occasion to look at the rock face immediately to the south of the plant that would -- I think we've talked about as being the APAC site?
A. Yes.
Q. Is there any sign in there of voids or any sign of a karst topography or caves at that point?
A. Nothing that I could see at that point.
Q. Did you have a similar occasion to look at the APAC site across the river which is probably a 150-foot high wall that extends? Did you view that

Page 195

site?
A. Yes. I've seen that site several times.
Q. And is there any sign in that area of any signs of karst topography?
A. Not other than, you know, one could... It would be difficult, but just to argue there is solution pockets. It's fairly common when blasting in this state that you'll come across every once in awhile a bench of rock that has a solution pocket or a little cavity, if you will, within the rock mass.
Q. But that's not necessarily, from your understanding, karst topography; that's just common in limestone or any kind of stone?
A. Yes. It can be found even outside of that realm.
Q. And if you encountered those little pockets while drilling, is it anything to take precautionary measures to handle those little voids or pockets in your blasting in terms of stemming or delays?
A. No. Actually, that's one of the things that I address in the geological considerations of blasting in the Missouri Limestone Producers certification and the Kansas certification when I'm training on that. We specifically address how to overcome any little voids or gaps within the

Page 196

explosives column, whether it be blocking off the hole by a myriad of means or actually shoveling inert rock into the hole to fill the cavity, whatever the case may be, but once the cavity -- once there's a cavity acknowledged there, we simply just don't load it with explosives because it's not the bore hole.
Q. Just turning while we're here on the Magruder work, do you have any written contract with Magruder?
A. No.
Q. And by you, I mean Dyno Nobel.
A. Dyno Nobel. No.
Q. Do you understand from discussions with them what continuing relationship Dyno would have with Magruder on this project?
A. From the discussions I've held with people within Magruders, it was determined that Dyno Nobel would provide the blasting for the Lake Ozark project.
Q. And by providing the blasting, what does that really mean?
A. Well, that means we would be involved in actually helping to lay out and design the blast of the shots, and then we would be the ones to actually come in and load the blasts after their driller has

Page 197

drilled the blast pattern for us. So that would include us loading the holes, delay timing the blast, and then we would set up any additional seismographs beyond any they may employ themselves or may employ through the use of a third party. And then on top of that, too, we videotape all of our blasts as well.
Q. When you're providing, like, a contract blasting service for a company like Magruder -- is that the proper term? Are you called a third-party blaster? What's the industry phrase?
A. The industry phrase is just that we're a contractor.
Q. And is that -- the use of contract blasters, is that something that in your view is growing in the quarrying industry?
A. It's extremely common, especially after 911. There became more stringent laws on the storage of explosives. And there's also the necessity to maintain security of personnel and so forth, and it was just a whole lot less liability for most of the companies to have a blasting company come in and actually provide the service as opposed to storing explosives materials on their own site.
Q. Without getting into the details on your client list, how many contract blasting sites do you

Page 198

all work on today in Missouri?
A. I couldn't even begin to count.
Q. Well, I mean, three or...
A. Dozens. Dozens.
Q. Is that all over the state?
A. Yes. It's all over the -- well, the eastern half of the state of Missouri, and then we have joint ventures that are actually on the western side of the state of Missouri.
Q. Can you name some of those sites without getting into --
A. Yes.
Q. -- privilege?
A. You mean as far as some --
Q. Yeah. Where you're providing contract blasting services.
A. Well, we provide blasting services for Capital Quarries, Central Stone Company, Unimin Corporation. We also provide it for Boozy Unisum (ph), ISP Minerals. I know there's more. I'm just trying to think of all of them.
Q. What about are your blasters out on a daily basis in the state of Missouri performing blasting?
A. Yes. Unless -- I forget, we do blast at some of the Magruder locations here in the state of

Page 199

Missouri, yes.
Q. But it is on a day -- so you're out seven -- or five days a week performing blasting services even today as a third party blasting?
A. Yes. There's usually multiple blasts that we're doing in Missouri. We typically have anywhere from two to four blasts or potentially even more just out of our Hermann, Missouri, site. We also have a Pittsfield, Illinois, location that deals with the northeastern section of the state because of their proximity to that. And then we have our office in southeast Missouri as well. So on any given day we could have a half dozen or more blasts being initiated in the state.
Q. Do you know how Missouri rates in terms of limestone production in the nation in terms of number of quarries and the quality of stone?
A. I'm not sure of the exact ranking. I just know they're within the top ten, to my knowledge.
Q. And is a lot of that stone located on the Mississippi River from St. Genevieve at Tower Rock clear up to Pike County and Central Stone and Magruder?
A. Well, the quarries are basically located throughout the entire state, I mean, so yes, it would

Page 200

include all along the rivers, all along the major rivers, all along minor rivers, minor creeks. I mean, you name it, quarries basically are usually found in pretty close proximity to waterways.
MR. BROWNLEE: At this time, your Honor, we'd like to either get set up a minute on the slide -- the narrative program. And could I take, like, maybe five minutes?
HEARING OFFICER: I was going to say, let's take a break, try to be back here at a quarter 'til by the clock on the wall, and we'll have the slide show set up by then. So we are in recess and off the record.
(Brief recess.)
HEARING OFFICER: Let's come to order. We're back on the record, and we're ready to proceed with the presentation of Applicant's 10, the report of Mr. Henderson, correct?
MR. BROWNLEE: Yes, sir.
HEARING OFFICER: Proceed.
Q. (By Mr. Brownlee) Mr. Henderson, we at this time would turn to Applicant's Exhibit 10, which is your report. And I'm not sure you're going to refer to every slide, but what we've been doing is just have a narrative rendition and go through and make

Page 201

reference to the slide, page numbers as you're changing. Just as we go, I may interrupt if there's a question that comes to my mind, and then Mr. Mauer will be able to go back through each slide and ask you specific questions. Okay?
A. Yes.
Q. Thank you.
A. The first slide here is basically a list of four uses of explosives. Simply there's four basic types of work explosive performs when loaded into rock. And of those, of course, there's fragmentation and movement of the rock which is what the quarry operators want and what we want, and then as a result there's ground vibration and air blast as well. It's a residual effect, but nonetheless when we're dealing with explosives, we're dealing with a tremendous amount of energy, and as a result we want to design our blasts such that we maximize the fragmentation and the movement of the rock. And that in turn is going to help lessen the impact or the amount of energy that's left for ground vibration and air blast.
So a lot of times you get into a situation where a person will say, well, gee, you don't care about my house or you don't care about a structure

Page 202

off site or you don't care about a particular thing, you only care about how you fragment and move the rock. Well, we do care about all those things because the fact of the matter is, the more we fragment and move the rock, the less energy will go into ground vibration and air blasts. So actually the best fragmentation and movement is going to result in lower ground vibration and air blast relative to a shot that doesn't have proper fragmentation or movement.

This is an aerial that I just pulled off of Google Earth. You know, I just kind of roughly drew the lines in here to approximate the issues that were talked about. And I did this on my own just so that I would have a way to put this up in the slide presentation itself. So these may not be exact or precise numbers, and that's why I kind of note them as approximately, but the current plan as listed was that excavation of the rock would start here in section A and then we would progress back along this bench slowly as we would eventually mine to -- I guess you would refer to that as the east or towards the pipeline.

And I've got listed here that the sewer line -- at this initial starting point, it's

Page 203

approximately 1,000 feet to the sewer line and approximately 1,500 feet to the sewer plant. And that, again, was based off just a rough estimate taken off Google Earth. It may be slightly closer or slightly further away. But you can see the easement of the sewer line coming down through here, as well as the easement for the overhead utility lines.

And, again, the proposal was to set the plant up down in this area to start and take section A back first and then eventually progressing to section B and then to section C. Slide 3 has actually been covered, I believe, through prior testimony. It refers to the blast plan. And this is just reiteration out of the blast plan itself that basically states that for a typical dry hole design that we would have 8 foot of burden.

And just for clarity, I don't want to get too jargon-loaded here, but burden is simply the amount of distance from the front hole to the free face and the distance between rows of holes. And the spacing is simply the distance, then, between the holes in a row. Okay? So when we refer to burden and spacing, that's what those parameters address.

Q. And under the Magruder site -- let's just forget wet hole, dry hole. How often would this shot

Page 204

illustrated in Slide 3, how often would this occur on that site?

A. Well, to my knowledge, they're doing about 300,000 ton was the rough estimate, and this particular design was designed to be about 10,000 tons per shot, so you're looking roughly, depending on their running and so forth, roughly about once a week or maybe less, depending on their production needs.

Q. So it could be two to three times a month that there would even be what you'd call a single blast?

A. Yes. That's correct. The stemming is simply just inert crushed stone that we put in on top of the bore hole. Again, the purpose is to confine the charge so that energy has to work it's way through the rock mass on the burden and spacing parameters. And that's listed as 7 feet. And then we have the hole depth of 50 foot listed.

Now, that depth is just kind of a starting point. I believe Dr. Worsey addressed in the plan that basically, as is typical with quarries, they bench blast to the closest dominant bedding plane within a few feet of their intended design to be able to strike a smooth floor for the loaders to operate

Page 205

off of. But it should be within a few feet of that estimation. And then that would leave an explosive column, then, of 43 feet, the 50-foot depth minus the 7 foot of stemming with an explosive calculated at 4 and one half pounds at .82. That would calculate out of 194 pounds per hole. And then a 10,000-ton shot would take roughly about 25 holes. So you're looking roughly at about three rows of either eight or nine holes per row.

And, again, the idea is that we would initiate that with one hole per delay, meaning that we're only designing it -- delay timing each hole so that there would be at least an 8 millisecond separation in between them.

Q. When you would discharge this blast on the Magruder site, in terms of a seismographic reading, would you have 25 separate readings, or how would that -- how would that appear on a seismograph on this particular shot?

A. No. The actual size -- this is a relatively small shot by the standards of most shots throughout the state, and the shot would take roughly anywhere from a third to half a second for total initiation, and it would show as just one event on the seismograph itself.

Page 206

And the next slide is just simply an illustration of one tiny possibility to achieve one hole per delay, but it's just to address the fact that in certain circumstances we're going to have only one free face available to us, and in that circumstance then we will actually typically pull the blast out of the center and then delay time it such that each hole would have its own subsequent relief.

Q. Now, when you did -- if this were, again, illustrative of a Magruder blast, when you set the charges off at each one of these indicated holes, which way would the stone move?

A. Well, the stone will move primarily to the free face itself.

Q. The upper side of the slide?

A. Yes, the upper side of the slide.

Q. Then it would be picked up and processed through crushers or whatever at that point in the quarry?

A. That's correct. And it's delay timed specifically such that you can see, for instance, here the starting hole would go first and then the hole next to it at 25 and then 42 and it would progress that way. The idea is that this hole has relief out the free face, as does the rest of the

Page 207

face holes, so we need to time it properly so that each hole has its own source of relief so that basically we're blasting these holes in front to make room for the next holes to come in behind it and have a source of relief as well.

Q. And for illustration purposes, where in relation to the free face would this pipeline be?

A. The pipeline would be to the bottom of the slide. From the initial blast standpoint it would be several hundred feet behind the shot.

Q. I thought you originally had 1,000 feet.

A. Well, that was, yes, approximation. That's why I say it would be several hundred, so upwards of close to 1,000 feet at the initial point.

The second slide is a similar-type slide. It's just a slightly different illustration. It's not showing on the screen too well, but I believe it is on the actual printed-out slides where there's a source or two points of relief; in other words, there's a corner, opening corner, on the face.

Q. This is how stupid I am. You can't move the projector and change it, can you?

A. Well, on the actual submittal here you can see the free face.

Q. So there's a free face on the left side of

Page 208

this slide?

A. Yes.

Q. As well as the free face that shows up on it? And on Page Number 35 of your document it's indicated?

A. Yes, that's correct, it is. And the idea again is that we want to utilize the source of relief, so in this case here, this particular hole on the corner would be the opening hole, and we would then simply progress down the open face and then provide adequate timing in between rows for the rock again to move primarily to the upper direction of the slide.

When we talk about structure responses, there's basically two types of structures, looking at Slide 6 here. And restrained or restricted structures are those structures which are completely buried or confined by the ground itself, in other words, they can only move as the ground moves. And, again, that's indicative of buried pipelines, well casings, buried utilities.

Unrestrained or unrestricted structures are structures, then, that are attached at the ground, but it has a fairly substantial part of the structure above the ground, and as a result they can

Page 209

actually move independently of the way the ground moves, such as houses, towers, bridges, et cetera.

Q. And is the unrestrained or unrestricted structure what the Missouri Blasting Safety Act described as an uncontrolled structure?

A. Well, the uncontrolled structure as put in the Missouri Blasting Safety Act would fall under unrestrained or unrestricted structure for the purposes of this slide demonstration, yes. And the restrain would simply relate, then, to the pipeline that would be on the Magruder property.

Referring to Slide 7, then, Structure Response and Restricted Structures. Again, they can only move with the surrounding ground. They can only move as the ground moves or in face with the ground itself, and again, that's representative of buried pipelines and utilities, et cetera. They're very resistant to vibration damage, and it is typically buried structures can withstand values of up to 20 inches per second or higher as far as actual peak particle velocities.

Q. And, again, that 20 that you said can typically withstand, that is, a pipeline of 20 IPS, what would be the limitations utilized on the Magruder site?

Page 210

A. Well, we'd actually reference as a limitation for the buried sewer line a recommendation set forth in RI 9523 by the U.S. Bureau of Mines, which would be 4.92. Now, keep in mind the one thing -- just because there's a limit of 4.92 inches per second, that doesn't mean we're going to encroach that limit as close as we can or see how close we can get to it, because again this all goes back to the very first slide that the best blast for Magruder is going to be the one with the least amount of ground vibration and the least amount of air blast. So the idea is if we have ground vibrations that are getting in the upper ranges, we're going to start looking at that from the blasting efficiency standpoint as well as the protection standpoint, because the other thing is, I mean, obviously with the pipeline running there and the Osage River close by, we don't want any potential situation where we can possibly rupture that pipe and cause a spill into the water.

Q. And, again, what is the best measurement of the actual vibration that will occur at either the sewer plant or the pipeline?

A. Well, the best vibration measurement would be through the use of a seismograph.

Q. And do you intend to use those on a

Page 211

continual basis?

A. Yes. We'll use the seismograph at both the pipeline and at the sewer treatment plant as well.

The subsequent slide is simply just kind of a further illustration of what we're talking about as far as restricted structures and their response to a shot initiation. This is not intended to be to scale. It's just simply an illustration.

Q. Mr. Mirabelli, I think, went through these in pretty careful detail. I don't mean to cut you off, but I just think that we had a pretty careful discussion of that and you could move through them, unless there's anything in particular you would want to point out, clear up through Slide -- I believe it would be Slide 11?

A. Well, it may be a reiteration, but basically along the lines of that is the point of the shot initiation, the energy that is emitted from the holes, if you will, or goes out from the holes on Slide 9 there. That's what actually creates the fracture network around the whole. Now, the thing about the vibration energy is that, again, this pipe is going to move as the vibration energy comes through. And the only real concern that we have is whether or not there would be any potential for

Page 212

permanent ground displacement through that pipe, and the idea, of course, being is this: If a 4-inch hole is capable of actually creating permanent ground disruption 150 feet behind itself, well, then our pattern would be a whole lot larger than an 8-foot by 12-foot, because that would actually save Magruder a lot of money not to have to drill the holes so close together.

Q. So the limitation on the actual hole that is drilled and loaded with, what, 43 feet of explosive, does it make it impossible to create a permanent ground displacement at 1,000 feet any more than 150 feet?

A. Well, at 150 feet it would be extremely unlikely, and the reason is because, as we'll see in the U.S. Bureau of Mines studies that I referenced, they even note that permanent ground displacement around the shot was contained within 44 hole diameters, which in the case of a 4-inch hole would calculate well below 20 feet immediately behind the blast.

Q. So that would be the permanent ground displacement is, what, 44 times the 4-inch hole?

A. Yeah, 44 times 4-inch.

Q. And that would be what the crater zone would

Page 213

be or the zone of permanent ground displacement?

A. Well, yeah. It wouldn't be the crater zone, per se. It would be the potential for permanent ground displacement would be basically within that realm. In other words, some cracks or things immediately behind the blast itself. And it also stands to reason why -- I mean, simply from the blasting standpoint, if we were pre-fracturing the ground tremendously right behind the hole, we wouldn't be able to get back out there to drill the next round of shots. Keep in mind that that hole, that front hole, is going to be placed at 8 foot. Well, we're not going to be able to drill a hole at 8 foot if the ground is all cracked and broken up because the driller wouldn't be able to get safely back out there and drill that particular blast hole.

Q. So on top of the bench you still have to have access to drill holes for future blasting?

A. Yes. You typically see very little cracking at a significant distance behind the shot at all. There is very little whatsoever. And the reason why is because it's a whole lot easier for that explosives to move out the 8 foot of rock in front of it than it is to try to displace anything behind it.

The fact of the matter is explosives is

Page 214

energy and it's going to seek the least path of resistance. And that's why we design the parameters the way we do, so that each hole will interplay with the other to get maximum relief and fragmentation and movement. So, again, as the vibration energies go out and actually come into contact with the pipeline, the pipeline itself is going to move in face with the surrounding rock and soil, then, around the pipeline. And, again, I'm sure Mr. Mirabelli covered that.

And our real -- only real concern is whether or not there would be actually any permanent displacement or an actual shifting or movement of the ground into the pipeline as we get back closer. And, again, the fact is that the 150 feet, the purpose of that barrier, is to help ensure that, because actually when I was asked to go look at the site for the very first time, Mr. McDonald asked me, he said, well, what's your thought of how close we could blast within that pipeline based on what you see? And I said, I wouldn't be afraid of going up within 50 feet of that pipeline. And they actually chose the 150 feet as just an additional safety, if you will.

And there's some economics, I mean, to it as well, because as you get back towards the pipeline, the elevation drops off and the bench

Page 215

heights actually would get short enough that it would be more prohibitive to go after that rock. It would be a little more expensive rock to excavate.

HEARING OFFICER: Mr. Henderson, let me interrupt for a moment. Let's just take that slide right there, and if I were to redo that slide and I'm taking that blast hole and I'm moving it up and it is setting -- the bottom of that blast hole is sitting a minimum, a minimum, of 2 feet above the pipeline, in that scenario, from 150 feet away, is it possible for rock to be pushed into the pipe?

MR. HENDERSON: No. Not at all. And the reason is because part of the process detonation actually is that the compression waves that go out from the hole are actually reflected back when they reach an area of different density, and that creates the tensile or fracture network. So it actually is conducive to the breaking of the rock to have a free face. So areas that are below that blast hole are not going to be subjected to that fracture zone the way that the areas immediately around the rock is. In other words, the explosives aren't going to break down into the rock mass, because, again, it's the energy that's going to take that least path of resistance out the free face. So if that bore hole

Page 216

were actually shifted up and the bottom of the bore hole would be at what would be the surface there on the slide, the chances of actually sliding a massive rock into that pipeline, especially at 150 feet, are just almost astronomical. I mean, it just gets close to being impossible. I mean, I couldn't foresee it.

HEARING OFFICER: Even from rock which would be up and to the side of the pipeline?

MR. HENDERSON: You mean but above the ground level?

HEARING OFFICER: Well, above the pipeline looking at this to the right and above the pipe, pushing rock down. You're saying the blast is such that the floor of the blast hole, it would not --

MR. HENDERSON: It would not fracture or shatter down, that's correct.

HEARING OFFICER: All right.

MR. HENDERSON: And that's exactly how they can hold the floors in the quarries as well, because if that were the case, there would be tremendous potholing of the quarry floor. Okay? Does that make sense?

HEARING OFFICER: Yeah. Sorry for the interruption, but you clarified a point in my

Page 217

mind.

A. So in relation, then, to one of the studies I looked at -- and, again, this is in relation with the paper -- preliminary paper done that was actually going to become, if you will, the U.S. Bureau of Mine's RI 9523. This is their preliminary paper to Response of Pressurized Pipelines to Production Size Mine Blastings. This is a study done by David E. Siskand and Mark Stagg of the U.S. Bureau of Mines Twin Cities Research Center in Minneapolis, Minnesota, in which they conducted a test where they buried four welded steel pipelines ranging from 6-inch to 20-inch diameter and one 8-inch PVC water supply line. And the idea was that they actually buried those pipelines in conjunction with the same bench that they were blasting on in order to see what kind of results blast vibrations would have on the pipelines themselves.

Q. (By Mr. Brownlee) Was this the study that finally went into the Bureau of Mines document that we've been discussing?

A. Yes. It is basically the 9523 study. This is just a small preliminary.

Q. Okay. Why don't you turn, because we've been again through this and I don't want to prolong,

Page 218

turn to Page 14, and I think you've done a comparison of that study and to what exists at the Magruder site. Is that a fair statement?

A. Well, yes. And just real brief, I would like to emphasize, if I could, on Slide 13 that the last mining cycle brought the production blasting within 48 foot of the closest pipeline. They noted that there was little back break and no apparent permanent ground displacement at this minimum distance of 44 hole diameters. Vibration levels were 25 inches per second for this blast, and we have no intention whatsoever to even coming remotely close --

Q. How does that compare to the Magruder site, the 25 inches per second?

A. As far as possible to achieve?

Q. Yeah.

A. Well, I guess if you set the seismograph close enough you could maybe get a reading that high, but we would -- again, we are actually going to comply with a limit of a minimum of 4.92, and we will probably stay well below that limit as well.

Q. So we'll be at a maximum of 4.92 as opposed to this study which was at 25 IPS?

A. Well, yes. They received up to 25 inches per second. And in that case, again, there was no

Page 219

permanent ground displacement, you know, back beyond that 44-hole diameter distance. And the ground -- now, the vibrations at the ground were 25 inches per second, but on the instrument pipeline itself the vibrations were 9.2 and 10.8 on the two instrumented pipelines with no loss of pipe integrity, as noted in the study.

What I did on Slide 14 was just to give a little bit of a comparison, what's going on as far as Magruder compared to the U.S. Bureau of Mines and is there any similarities. Well, myself I'm not a pipe expert, but nonetheless what their study included was steel pipeline and PVC pipeline. Magruder's is including ductile iron pipe and PVC pipe. And, again, I'm no pipe expert, but needless to say, iron and steel are not too many molecules from being similar.

MR. MAUER: Move to strike, your Honor. He just said he's not a pipe expert.

HEARING OFFICER: All right. Let's strike the reference to the iron and steel molecules.

A. Okay. So the depth of burial was 36 inches of soil cover at the U.S. Bureau of Mines, and the depth of burial at the Magruder site was noted as 36 inches or slightly more than 36 inches.

Page 220

The differences? Well, they were blasting at the level or below the pipeline level, and at Magruder's we'll actually be blasting -- blasting will be conducted above the pipeline level, so there would actually be less -- we would expect less stress and pressure on the pipeline as a result since we're actually going to be above the ground that that pipes in.

In addition, they were using a 12-and-a-quarter-inch hole with 41.9 pounds per foot would be the calculated weight of the explosives at a distance of 48 feet. Now, that's nearly ten times as much explosives as we will be using, and they are at a distance of three times closer than what we're proposing to stay.

So, you know, all these things in relation, I mean, there's a huge difference in the fact that these are very large diameter holes and very close proximity. We're going to be using much smaller diameter holes at a greater distance on the Magruder property.

Within the follow-up study RI 9523, the U.S. Bureau of Mines paper mentioned Siskand, et al., noted previous work by Lewis L. Oriard. And this is a quote directly out of the study itself. It says,

Page 221

"His involvement with many large pipeline projects as well as roughly 350 urban pipeline and utility projects has Lead him to conclude that the blasting risk to pipelines is from block motion permanent strain, permanent displacement of the ground or having the pipeline in the actual blast crater zone itself." Okay? "He suspects that no elastic wave or vibration velocity is needed, nor is it meaningful." So simply put, you know, vibration limit is not even on his radar screen in regards to blasting near a pipeline.

Also within the report they noted Jack L. Kiker reported to Siskand, et al., of blasting within 10 foot of a 20 -- I'm sorry -- 10 to 20 foot of a pipeline. In one case a parallel ditch within 4 meters or 13.12 feet of the blast had ground rupture cracks extending to the existing pipeline and in which the peak velocities were 64 millimeters per second or 2.52 inches per second without damage. Another case involved blasting within 1.2 meters or 4.59 feet of a 30-centimeter or 11.81-inch PVC sewer pipe. Vibration amplitudes were up to 1,450 millimeters per second -- and I apologize, I forgot to convert that, but I believe it's right at 57 inches per second -- and produced no damage. So

that's quite a magnitude of vibration. The burial depth was 1 to 1.2 meters or roughly a little over 3 feet.

Kiker, like Oriard, believes that the risk to pipelines comes from ground rupture and movement, not from vibrations, per se. And the conclusions in 9523 -- and this is again where I arrived with the 4.92 -- is that although particle velocities were over 600 millimeters per second or 23.62 inches per second were sustained without loss of pipe integrity, it is recommended that 125 millimeters per second, or converted would be 4.92 inches per second, measured at the surface is a safe level criterion for large surface mine blasts for grade B or better steel pipelines. The same criterion is recommended for SDR 26 or better PVC pipe.

Q. And how does that relate to the PVC pipe at the Magruder site?

A. To my knowledge, it's the same type of pipe, SDR 26.

Q. Thank you.

A. Subsequently I also included another one from Lou Oriard in here where he had a combined limit of 12 inches per second with a criteria for ground fracture control. There was an unexpected proof test

when 7,000 feet of trench -- now that's over a mile of trench -- was blasted instantaneously with no delays at a distance of 25 feet. No damage was done. Tests were conducted prior to the beginning of the project.

Welded steel pipelines, he notes, are very consistent to high frequency ground vibrations but are again relatively sensitive to ground shifting. So ground control is essential to the prevention of damage when blasting in very close proximity. I always insist on that control but do not insist on vibration limits.

Then in relation to that, this is a slide that I made again using the Google process here, and basically this is a quarry we shoot at in a location in Lodi, Missouri. And you can see right here the quarry is located -- that is the actual pit itself on the -- in that area right there, and the red dotted line, I overlaid the pipeline that is running through. This is a steel pipeline that is, to my understanding, carrying crude oil.

And the next slide illustrates one blast that we initiated on November 8th of '07. You can see the shot parameters here are 9-foot by 11-foot pattern with a bench height of 23 to 38 feet. There

were 47 4-inch holes, and our pounds per delay or any given amount of explosives going off within that milliseconds was 180.38. Our actual seismograph readings were 2.1, 1.72 and 1.76 on the three channels.

And the seismograph -- I'm not sure if this has been brought up yet, but the seismograph measures in three channels, front to back, side to side and up and down. So that is basically all three channels. And in that particular situation I just used a little indicator as far as how close are we from here to the actual pipeline. You can see the clearing of the trees for the actual pipeline easement and you can see that we were approximately 170 feet from the blast. Now, in this particular location, again, we were blasting on the same level. This surface area is pretty close to the same elevational area as the pipeline itself is located. And, again, it was roughly equated to have about 3 to 4 foot of cover.

HEARING OFFICER: Are the figures you cited, those are PPV?

MR. HENDERSON: Those are actual seismograph readings related to that blast.

Q. (By Mr. Brownlee) Can you -- are they

explainable in terms of what they show? They're just numbers.

A. Well, let me explain it from this side. In this case here we're using 4-inch holes just as we intend to use at the Magruder site. In this case we were actually using a re-pumped emulsion which has a little bit higher density and would be more indicative of the type of material used in the wet hole example. And as a result, you're comparing here 180.38 pounds per delay. The dry hole example at Magruder has 196 pounds per hole, so you have about 16 pounds difference. The bench height itself is a little bit shallower, but again with the higher density product, that's why you have the higher pounds per delay in that particular application. Does that kind of help clarify?

HEARING OFFICER: Uh-huh.

A. Okay. The subsequent slide also references the same spot, in this case referencing a shot that was done on September 7th of last year. Again the distance to the pipeline is approximately 185 feet. In this case here, we actually had the shot on a 10-foot by 12-foot pattern, and the bench height was 42 to 50 feet in height. The shot consisted of 57 4-inch holes, and there was 549.93 pounds per delay,

Page 226

in other words, almost three times the pounds per delay that we're intending on using at the Magruder site. And, again, when you look at the seismograph information, you can see that this is well below the criteria that we were talking about, the 4.92, because I have a 1.56, a 2.44 and a 1.48 on the actual seismic reading.

Q. And are those -- those figures that you just alluded to, are those PPV figures?

A. Yes. Those are peak particle velocity figures, and the number alongside them after the hashmark, the 20.4, for instance, is the actual frequency of the monitoring.

Q. So to look at this from what we've discussed so far, the part that we can understand is the first part of the slash, that is, the PPV?

A. Right, the peak particle velocity.

Q. And in all cases right there, they're below the 4.9?

A. Yes. They're well below the 4.92 level listed in the previous slides. And, again, you know, in that case we're within 180 feet. We're on the same level as the pipeline itself. And needless to say, with the current price of crude oil, we would know pretty quickly if there was a leak, because I'm

Page 227

sure they would inform us quite quickly about that.

Q. But in that blast, the actual explosive was, what, three times what we're using at Magruders?

A. Well, it's nearly three times, because you have about 192 pounds per delay. You round that, basically, to 200. Three times, that would be 600. And we're 50 pounds short of that. So it's real close to three times the amount. So, I mean, the fact -- the fact is that, again, you can even see even aerial photo-wise there's, you know -- it's a little more difficult to see, but you can see there's not a permanent break or any disruption really visible in the ground at that time. This slide is a little bit off to the side. Let me make sure that there's... Okay. This is Capital Quarry's Stadium location.

Q. Let me interrupt you at this time. I think we've got another -- this will be Applicant's Exhibit 25.

HEARING OFFICER: This is an aerial of Jefferson City Capital Quarry?

MR. BROWNLEE: Stadium.

MR. HENDERSON: Yeah, their Stadium location.

HEARING OFFICER: Stadium? All

Page 228

right. Applicant's 25, Stadium location, Capital City Quarries.

A. What we need to point out here is -- now, I took these GPS readings back earlier this year, so there is going to be a little change in the fact that the bench has actually progressed back further, but I've noted up here on the slide as STA 1, STA 2, 3, 4, et cetera. I took several GPS points of the current rock face at the quarry. So I basically drew a line in between those points to illustrate where the actual free face of the rock is. In other words, this rock out in here is all gone as of just a little bit earlier this year, so the primary blasting production is taking place back in this area here.

Q. So all the rock from the line from Station 1 up to Station 5, all of the rock to the left of that is removed?

A. That's correct.

Q. And so that line that you've drawn between Station 1 and Station 5 is really now where the face would --

A. Well, it's where the face was at that time. Since then more blasts have taken place, and I'm sure the face has moved back. Well, I know the face has moved back further.

Page 229

Q. The face faces west?

A. Yes, that's correct, faces the west. In this particular location here I had in a previous -- I actually had to risk -- re-risk assess this quarry because at the time there was a Kohl's Department Store that was not present there last year and was under construction, and our blaster alerted me to the fact that a new building was going to be put in, so I went in and took GPS readings of where things were going to be.

And I've also got noted on here sewer 1, 3 and 4, and at the time I was -- I did not have the exact information on if that was the actual storm sewer or a sanitary sewer, and since we have -- this was received Monday, I believe, and from the Public Sewer Board -- or I'm sorry -- the Department of Public Works for the City of Jefferson City, and it does confirm, in fact, that is part of the actual sanitary sewer line, as can be seen on the Applicant's exhibit there.

MR. MAUER: Your Honor, I'm just going to note an objection to Applicant's 25. I just deposed Mr. Henderson last week. 25 was not provided. He said he may be getting some additional information. It's never been provided to us. In

Page 230

fact, I just received it right now. There's been no authentication for this, and I object to the admission of Applicant's 25 or the reference to it because as an expert we should have had fair warning as to the work that he's been doing and what he's done, and popping it on us in the middle of his testimony, I think, is inappropriate and I object.

HEARING OFFICER: When did you depose the witness?

MR. MAUER: Just last week. Last Thursday, was it?

MR. HENDERSON: Thursday.

HEARING OFFICER: Mr. Henderson --

MR. HENDERSON: I made notice at the deposition that we were waiting on the information to come in.

HEARING OFFICER: Is that correct, Mr. Mauer?

MR. MAUER: He said that there was potential for more information, but it was never provided to us.

MR. BROWNLEE: We just got it yesterday.

MR. MAUER: Well, if he got it on Monday, we could have had it on Monday. There's no

Page 231

authentication for it. I object to an expert that it not being provided to us until, I mean, halfway through his testimony.

MR. BROWNLEE: I think Mr. Mauer's right, we just got this yesterday afternoon, but I think it could be considered as being the location. It ties the sewer lines together that were -- that were indicated in the map that they had during the deposition, and beyond that it's kind of cumulative.

MR. MAUER: Actually, your Honor, the sewer designations are sewer 1, 2, 3 and 4 -- 1, 3 and 4 which are on -- as part of the report are on the far left side. According to Applicant's 25, he's now got it drawn in all along between the quarry site and Wal-Mart and he's got it identified over on the east side of the quarry, which was not information provided to us, nor did he testify about that.

HEARING OFFICER: I understand, but what I'm --

MR. HENDERSON: But what I did state was I wasn't sure --

HEARING OFFICER: Wait. Wait. What I'm understanding is at the time you took your deposition, at the time your deposition was taken, this witness advised you he was continuing to do work

Page 232

relative to the sewer on the Capital City project, correct?

MR. MAUER: Well, actually, I think what he said was that was information he hadn't received yet.

HEARING OFFICER: Okay.

MR. MAUER: I don't know that he was continuing to work, but that's what he said.

HEARING OFFICER: But you were fully apprised that he was going to testify relative to the Capital City Quarry, correct?

MR. MAUER: As represented in his report, yes, your Honor.

HEARING OFFICER: Okay. And at his deposition he informed you there was information he had not received?

MR. MAUER: Yes.

HEARING OFFICER: And my understanding is this information was received late yesterday afternoon, Mr. Brownlee?

MR. MAUER: I thought he said Monday.

MR. BROWNLEE: No. It was yesterday.

MR. HENDERSON: It was yesterday.

HEARING OFFICER: Yesterday. It was received yesterday?

Page 233

MR. BROWNLEE: I think he testified, if I recall -- and this is subject to check -- he testified he knew there was a sewer there, but in terms of the exact locations from the points indicated where it ran, we couldn't -- we didn't have that information at the time.

HEARING OFFICER: All right. My understanding is from the Jefferson City Sewer Board or whatever the governmental entity is --

MR. BROWNLEE: Public Works.

HEARING OFFICER: -- Public Works Department, you have verified that this is the location of the sewer?

MR. HENDERSON: Yes. That was the information that they have sent to us.

HEARING OFFICER: All right. The objection is overruled, notwithstanding that Mr. Brownlee didn't call you yesterday afternoon and say, oh, by the way, we've got where that sewer is located. The party was clear on notice that there was additional work being done with regard to the matter, so the objection is overruled. Now, wherever we were in the testimony.

MR. HENDERSON: Yes. I remember. I'll go on.

Page 234

HEARING OFFICER: All right. Proceed.
A. Basically in this relation the Station 1 marker is approximately within -- well, it's within 100 feet of what is designated or shown as Sewer 3 there. And, again, this particular quarry, the bench height -- and we'll see that on a subsequent slide -- is in excess of 50 feet. Now, in this particular location, too, we do shoot a 3-and-a-half-inch diameter hole as opposed to a 4-inch diameter hole at this particular location.
So right now the main development of the quarry is over in this area here. Their intention is to finish this development of the quarry to allow it to be opened up for commercial real estate, and the blasting is progressing back towards this CMA location, which is an athletics sporting goods store. And you see as well that there's Stadium Plaza, which is a little strip mall, and the Wal-Mart Supercenter. It's just to illustrate, more than anything else, that -- you know, I made the statement earlier that we blast all the time in areas where there are plenty of things to consider and plenty of things to be concerned about and we do so safely and effectively.

Page 235

And in this particular case here, too, we've not ever received any notification of a situation where the sewer pipe has been damaged or any other regards from various other locations as far as damage.
Q. Let me ask you, at the blasting that's going on at the Capital City Quarry location, is Dyno Nobel doing that blasting?
A. Yes, we provide the blasting.
Q. And at anytime prior or during this blasting did you know the age of the pipe of that sewer line?
A. No, we did not.
Q. Did you know the bedding or the fill requirements or the cover?
A. No, we did not.
Q. Did you know the depth?
A. No.
Q. Did you know the type of pipe that was there?
A. No, we did not.
Q. Did you know anything about the joints or the pressure line?
A. No.
Q. And in relation to not having that knowledge, did it enter into your concern as to

Page 236

whether you were blasting around that sewer line?
A. No. And, again, the reason is our main reference again is U.S. Bureau of Mines RI 9523 and, again, we know that pipelines themselves are very resilient to ground vibration and so, again, our only real concern or efforts is to make sure that we don't permanently displace or disrupt the ground and possibly shove something into the pipeline itself.
Q. Finally, if you'll turn to Slide 27, please.
A. Okay. Wow, that doesn't show up too well.
Q. Well, this obviously speaks for itself. Is that a situation that Dyno is blasting near at this point, or is this just a photograph you have?
A. No. That is the Capital Quarry -- it's referred to as Sullivan Quarry. It's between Sullivan and Bourbon, Missouri, and we're actually blasting that bench. It's in excess of 50 foot in height. We're using 4-inch diameter holes. And we're actually progressing right back underneath of those high lines.
Q. And how are those high lines supported where they have the holes? Are they on piers or --
A. The poles are just set into the ground themselves.
Q. But you're blasting underneath them right

Page 237

now?
A. Well, we're blasting back in that direction. This picture was taken, again, earlier, either early spring or late winter, if you will, and we have since progressed back further that direction. I don't have the exact location where we're at in that quarry right now, but we are progressing back towards those lines.
Q. Are those lines -- do they have any consideration in terms of the blasting limitations?
A. No. There's been nothing given to us by the utility company in regards to ground vibration limits. But we -- we, of course, made sure that our limits are, you know, self-imposed. We watch the ground vibration in relation because, of course, we don't want to do anything to damage the carrier lines.
Q. Turn, if you would, to Page 35.
A. Mine doesn't have the page number clearly on here.
Q. Expert opinion regarding blasting near the pipeline.
HEARING OFFICER: It's not my 35.
MR. BROWNLEE: Well...
HEARING OFFICER: You're working off

Page 238

a different copy than I have. Wait just a minute. Expert opinion -- 31 in the copy that I have.

MR. BROWNLEE: I think there's two duplicates that somehow got stuck in there.

HEARING OFFICER: Okay. 31. Because I've got a blank sheet. All right. Proceed.

Q. (By Mr. Brownlee) Explain this slide, if you would.

A. Okay. Well, as far as my opinion in regards to the Magruder property, vibrations from blasting operations are not allowed to exceed state limits at the closest non-mine structure, which in the -- at the initial time of actually opening and blasting within the quarry, that would be the sewer treatment facility. And, as such, all blasts have to be designed to be with those limits in mind.

And, again, when we talk about the limits, it's not that we're looking to encroach as close as we can to the limits. We actually prefer to stay well under those limits. It's in the best interest of Magruder as far as giving them the best, most optimal blast. The limits provided by the State are far more restrictive than the vibration levels needed to damage the pipe, and as such blasting vibrations will not damage the sewer pipe or the concrete sewer

Page 239

basin. And simply what I mean by that is this: Is that since we have to, but we still plan on monitoring as well at the pipeline, the amount of energy necessary to actually stay under the restrictions under the Missouri Blasting Safety Act is such that if we stay under those levels, we're not going to be able to generate such a high level of magnitude that we're actually going to exceed that 4.92, if you will, at the pipeline.

Q. In your 16-plus years of blasting experience, could you rate the level of difficulty or concern at the Magruder site versus all the other sites you've blasted at where there's a quarry operation?

A. On a blast of 1 to 100?

Q. Well, if that -- 1 to 100.

A. Okay. I mean, I would rate this under a ten if, you know, submitting this as a risk assessment to my superiors as far as the viability of doing business here and everything else, all these items would be taken into consideration. You know, if we really truly believed that there was a serious potential for loss and that even the slightest possibility that that pipe could rupture or the basins be damaged or anything along those lines, the

Page 240

negative economic impact of that would be tremendous.

And, of course, like anyone, I mean, it's not purely a matter of economics, because we have concern for the environment and surrounding structures as well. I mean, we want to be a responsible entity. Our reputation is based on that, and, you know, dealing with -- in dealing both with the general public and with the industry, you know, you want to maintain a proper responsibility in our duties. And I, myself personally am just not a believer in damaging -- you know, I would not -- I would not agree to provide blasting services where I really think that there was a high potential for loss.

Q. Is a 300-ton quarry considered in terms of Dyno's experience a small quarry option?

A. 300,000 tons?

Q. Yes. I'm sorry.

A. Yes. By our purposes, that's a small quarry operation.

Q. And would Dyno Nobel, would they even be involved in this project if they understood there would be an environmental risk that might affect the lake or the Osage River?

MR. MAUER: Okay. Your Honor, I'm

Page 241

just going to object. I don't think it's been established that this witness is capable of testifying on behalf of Dyno Nobel. If he is, fine, but I want to make sure that my objection is stated. If he's going to testify for Dyno Nobel as a company, then I've got some questions for him that he didn't want to answer in the deposition.

HEARING OFFICER: I believe you're correct, Mr. Mauer. I don't see the basis or foundation that this witness is qualified to speak for the corporation, and he is certainly not offered as such, at least to my understanding he is not here to testify on behalf of that corporation as to how they would view potential risk or liability of the corporation.

MR. BROWNLEE: Okay.

Q. (By Mr. Brownlee) Do you do risk assessments for Dyno Nobel?

A. Yes, I do.

Q. Is that part of your job?

A. Yes, it is.

Q. And does that include potential environmental impacts?

A. Well, it would include specifying the location of both the lines and the sewer treatment

Page 242

facility and, you know, further illustrating and showing to them -- I would give to them slides very similar or, well, pictures very similar to what we seen in one of the earlier slides in relation to where all those items are in relation to the Osage River and various other residences and so forth for full consideration.

Q. If you were asked to do a risk assessment on the Magruder property for Dyno Nobel, would you consider the existence of the sewer plant and the sewer line to be a risk factor that you might consider in determining whether you would or would not advise Dyno Nobel to take this project on?

A. Okay. Well, there would be the understanding, first of all, that those items are present and that the blast design would have to conform with the criteria that we would have within our own surface blasting standard operating procedures. And then also I would actually put into the risk assessment what the estimated values would be for peak particle velocity at the sewer line, as well as at the sewer treatment basin based on, again, items that are put forth in our surface blasting standard operating procedure.

And then based on that information a

Page 243

conclusion would be drawn by several others within the company as far as whether or not blasting would proceed ahead at this location. Now, I've been in contact with my own superior in regards to this situation, and --

MR. MAUER: Hearsay, your Honor.

HEARING OFFICER: Well...

MR. HENDERSON: I'll restate. Can I restate?

HEARING OFFICER: No. It's just I'm pondering in my mind the case law relative to experts. In forming an opinion they are allowed to rely upon a certain level of hearsay. I'm not sure where we're going, though. I'm not sure what the witness is going to offer here as far as what someone in the company has stated to him concerning this project for which he never did a risk assessment. So I'm going to sustain --

Q. (By Mr. Brownlee) I thought my question was closer, and you kind of wandered a little.

MR. BROWNLEE: Could you go back and read my question? Maybe I was...

(Whereupon, the requested portion of the record was read by the reporter as follows.)

A. Listening to that again helps, so... My

Page 244

advice in the risk assessment would be that we would take the project on based on the information that I have.

Q. (By Mr. Brownlee) You said you would?

A. I would -- I would advise them to go ahead and take the Magruder project on.

Q. Did you have any input into the actual drafting of this blast plan?

A. Basically I was in discussions with Dr. Worsey and Mr. McDonald both as we were going through the process, because, again, as they were drafting the plan, I just wanted to make sure that there was nothing in there that I would object to. I wanted to make sure that it was a plan I felt comfortable with.

Q. And during your employment with Dyno Nobel over the essentially 16 years, have you, yourself drafted blast plans?

A. Well, as far as the formal blast plans and submittal to projects like this, no. Typically I assist customers who are either drafting a blast plan themselves, but typically our blast plan is addressed with each customer on an individual basis. And we still deal on a fairly verbal basis. A lot of times there are actual follow-ups, but the current blasting that is being -- that's taking place in a quarry are

Page 245

in a location, you know, we will address issues related specifically to those current blasting operations.

Q. Are blast plans always written?

A. Well, not -- no, not always. I mean, again, there's -- it depends on, I would guess, a definition of a blast plan. If someone is saying a formal blast plan as far as a required submittal by an organization, whether it be a state regulatory agency or whether it be a private company entity, you know, in certain situations there are people that require a written blast plan, but they're not always required to be written by every -- every group we deal with.

Q. And is it your understanding that under Missouri law there's no requirement under Land Rec or the Missouri Blasting Safety Act to have a written blast plan?

A. Not to my knowledge.

Q. And is it in the normal course of procedure in your experience as blasting supervisor for Dyno, are blast plans regularly revised?

A. Well, yes, because typically what takes place is most blast plans or most blast start-up plans are a starting point, and then we adjust them from there. For instance, if we blast at the site

Page 246

and feel that the rock is a little bit on the coarse side, we may have to actually decrease the hole diameter or maybe even increase the amount of explosives used based on the actual knowledge of how the rock fractured, fragmented and moved.

Q. Assuming in 20 or 30 years this blasting went across the creek over into another area that would be permitted, would Dyno undertake blasting over there without having to do a full reassessment of the conditions at the site at that location?

MR. MAUER: Same objection, your Honor, to the extent he's speaking for the company.

HEARING OFFICER: No, he's not speaking for the company. He's speaking as an expert who makes these sort of assessments, and I'll take the testimony as that, not as a representation on behalf of Dyno. Overruled.

A. Yes, because I would have to resubmit, just as in the Capital Stadium situation where the introduction of the Kohl's Department Store was coming in helped trigger the need for a reassessment of that location. Then, too, anytime we would make a move beyond what had been spelled out in the first risk assessment, then we would address those issues independently and reassess that area relative to its

Page 247

proximity to those various areas of concern again.

Q. And have you in your dealings with particular quarry locations for Dyno blasting, have you recommended that blasting change while the operation is ongoing?

A. At any quarry location?

Q. Yeah.

A. Yes. I mean, it's not uncommon at all. In fact, most of our customers are very proactive and they look at their current blasting practices. They, of course, look to optimize their practices such that it will make their job more efficient, because the blast is the first source of fragmented rock for the quarry. So the blast -- the quality of the blast itself greatly affects the overall running cost of the operation.

And in addition to that, for instance, we have some customers that even have self-imposed peak particle velocity limits themselves that are even more restricted than what the State puts forth, and so, for instance, if they get closer to their own restrictive standards, they will ask ways to adjust and -- adjust their blasting so that they can help lower those limits again -- or help lower the actual peak particle velocities of each blast.

Page 248

Q. Finally, based upon your professional training and professional and individual blasting experience, your personal observation of the Magruder site, the technical knowledge of blasting, your review of the geological maps of the Magruder site, your review of the plans for the sewer pipes and sewer treatment plant, considerations performed reviewing the blast plan, your observation of sewer line locations, your observation of sewer plant locations, your knowledge of the materials utilized in the constructed sewer lines, the physical description of the plant as provided by Mr. Hutchcraft, your knowledge of the blasting contractor, i.e., your employer, and knowing that blasting will occur 700 feet from the sewer plant and 150 feet from the sewer pipelines at a minimum, do you have an opinion based upon your blasting experience as an expert whether the Magruder proposed quarry operations at the Lake Ozark site will have any effect on the sewer pipelines or sewer treatment plant?

A. They will have no --

Q. Do you have an opinion?

A. Well, my opinion is that they will have no effect in relation to either the sewer pipeline or

Page 249

the sewer treatment facility.

Q. Okay.

MR. BROWNLEE: At this point, your Honor, I think I'm essentially concluded, but I'd like to go off the record, if we could, because I wanted to discuss an issue with Mr. Mauer and yourself and Mr. Duggan about kind of the issue of where we are with rebuttal and Mr. Dressler.

HEARING OFFICER: All right. At this time we will take a short recess, and we're off the record.

(Brief recess.)

HEARING OFFICER: Let's come to order, Gentlemen. We're back on the record and --

MR. BROWNLEE: One little question, one little area.

HEARING OFFICER: Mr. Brownlee.

Q. (By Mr. Brownlee) Have you had a chance to review BP-19?

A. Yes.

Q. And what is that?

A. That is the report issued by the Fire Marshal's Office regarding a complaint at the Sunrise Beach quarry.

Q. And there is an indication on that blast --

Page 250

that a blast detonated by Magruder, quote, "Temporarily exceeded the limits." Have you reviewed that and can you explain that?
A. Well, in that particular situation they're referring to the actual blast distance, and again, that falls back into the parameter that a seismograph was used, so the actual blast distance didn't have to be calculated. And that actually, you know, came up as a topic in the open meeting of the Blasting Safety Board the last time. But in this particular situation where it says they've temporarily exceeded the allowable charge weight for the actual blast distance, that would only be true if the -- if there was no seismograph utilized.
Q. But there was a seismograph?
A. Yes. It states down here further in the report, "In reviewing the blasting log, it was noted that approximately 7 and a half feet of 3-quarter-inch rock was used as the stemming in each hole. It was also noted that PVC was registered .46 and the decibel was recorded as 130 at the location of the seismograph during the shot."
Q. So the conclusion that it was exceeded is incorrect since the seismograph was used, correct?
A. That's correct.

Page 251

MR. BROWNLEE: I have nothing further. Thank you.
HEARING OFFICER: All right. Mr. Mauer, cross-examination?
EXAMINATION
QUESTIONS BY MR. MAUER:
Q. Mr. Henderson, good to see you again.
A. Good to see you.
Q. Before we let go of that exhibit you just had, from this Fire Marshal's report can you tell me the location of the seismograph?
A. It's noted that the -- above here that the measurement to the blast site from Jeff's Auto Sale to the nearest uninvolved structure was measured to be 550 feet.
Q. Do you have any idea where that seismograph is in relation to Ms. Sallach's house?
A. No, I do -- well... Yes, I do. There's a diagram on the last page here.
Q. And where does it show -- the diagram, where does it show that the seismograph is located?
A. It says that the seismograph is located at Jeff's Auto Sale. Looks like it would be directly behind the blast in question.
Q. Right. And the Sallach house, according to

Page 252

the last page of this exhibit, is clear on the other side of the quarry, the other side of the blast and the other side of Jeff's Auto Sales, right?
A. Yes. More than twice as far away as Jeff's Auto Sales.
Q. But the seismograph isn't measuring -- isn't located there by the Sallach residence, is it?
A. No, it is not.
Q. It's on the other side of the blast, right?
A. It's on the -- looks -- according to the drawing, it would be on the far end -- the other side of the quarry.
Q. So from looking at that seismograph information that you just testified to, you're not testifying that that was the seismograph reading at the Sallach house?
A. No, I am not.
Q. Okay. Thank you. I'd like to talk about some of your training and education. Have you ever received any training as a structural engineer?
A. No, I have not.
Q. Have you ever received any training in the installation of cement or concrete?
A. No, I have not.
Q. Have you ever received any formal training

Page 253

in the performance and structural integrity of concrete?
A. No, I have not.
Q. And with respect to construction, the only education you've received in construction would be with respect to blasting?
A. That is correct.
Q. Have you ever had any course of study with respect to pipes?
A. No, I have not.
Q. Have you ever had any course of study with respect to the installation of sewer lines?
A. No, I have not.
Q. Have you ever had any formal education or on-the-job training of any -- or any sort of education with respect to pressurized pipes?
A. No, I have not.
Q. Have you ever had any sort of education with respect to the fracture testing of pipes?
A. No, I have not.
Q. Have you ever had any sort of education, training or experience with the operation of a sewage treatment system?
A. No, I have not.
Q. Have you ever operated a sewage treatment

Page 254

plant?
A. No, I have not.
Q. How many sewage treatment plants have you ever worked in?
A. I have not worked in a sewage treatment plant.
Q. How many sewage treatment plants have you ever even toured?
A. I have not toured a sewage treatment plant.
Q. Other than just knowing that sewage is treated in a plant, raw sewage comes in, clean water comes out, do you have any other knowledge or experience with respect to a sewage treatment facility?
A. Not other than just they're basically, you know, what I can see from the distance, you know, concrete basins holding and -- holding the various sewage parts.
Q. Have you ever even been inside the fence or toured the sewage treatment facility there by the Magruder quarry?
A. No, I have not.
Q. Have you ever interviewed or even spoken with anyone who works in or operates that plant?
A. No, I have not.

Page 255

Q. Have you ever received any formal training on how to analyze the construction of a sewage treatment basin?
A. No, I have not.
Q. Have you reviewed any information regarding the electronic equipment on site at the sewage treatment facility?
A. No, I have not.
Q. Have you reviewed any information involving the condition of the valves or other mechanical equipment and pumps on site at that sewage treatment facility?
A. Can you repeat that question again?
Q. Have you reviewed any information involving the condition of the valves or other mechanical equipment and pumps on site at the sewage treatment facility?
A. Well, I believe I mentioned earlier that I have briefly reviewed the information that was sent to me in regards to the information regarding the sewer plant and the pipelines.
Q. And that was the mega flange connectors that you testified about earlier?
A. Well, I looked at that and, as I said, cross sections of the pipelines themselves and reviewed

Page 256

through some of the information in regards to the sewer treatment plant. And basically I reviewed through all the diagrams.
Q. Any of those diagrams that you -- is it your testimony that then you reviewed information about the valves, the condition of the valves and mechanical equipment and pumps on site in the sewage treatment plant?
A. Do you mean physically?
Q. Yes, sir.
A. No, I have not physically.
Q. How many lines are you aware of that actually flow into the sewage treatment facility?
A. I'm aware of two.
Q. And do you have any opinions that you're here today to offer about the environmental impact of a sewage spill on either Lake of the Ozarks or the Osage River?
A. No, I don't have an opinion on that, beyond I don't believe that would be a possibility based on the information that I've provided as far as a possibility of a break in relation to blasting at the site.
Q. Are you here today to dispute that if raw sewage runs into the river or the lake it will create

Page 257

an environmental problem?
A. No, I'm not going to dispute that. That's precisely why we evaluate that and consider that as part of what we do and what I will do, actually, in the risk assessment, because we don't want that to be the case.
Q. And, in fact, with that environmental assessment -- that risk assessment, excuse me -- that's going to be submitted to other people within Dyno Nobel who would have to approve before Dyno Nobel would undertake this project?
A. That is correct.
Q. So as you sit here today, you, yourself cannot commit Dyno Nobel to taking on this project, true?
A. Not personally and alone, no.
Q. So you cannot testify that even if this permit is granted Dyno Nobel will actually be the blaster on this project?
A. Not of my own personal volition, no.
Q. Thank you.
A. But I would state that I will recommend that it be done so, and I have not had any of the recommendations that I --
MR. MAUER: Move to strike, your

Page 258

Honor. Non-responsive.
HEARING OFFICER: Non-responsive. The last testimony of the witness is stricken.
Q. (By Mr. Mauer) And isn't it true -- you testified earlier about when you have done these assessments on blasters employed by Dyno Nobel. Do you remember that testimony?
A. Yes.
Q. Isn't it true that when you have done those assessments you are aware of situations where blasters employed by Dyno Nobel have failed to follow the procedures established by Dyno Nobel?
A. I believe what I had testified to was the fact that it's also a process in which we do on-site training and we specifically look for any potential gaps that there may be to ensure that it's not simply a lack of understanding as opposed to a lack of compliance.
Q. So is it fair for me to understand that you are aware of situations where blasters within the employment of Dyno Nobel have failed to follow the procedures established by Dyno Nobel and as a result have been disciplined for that failure?
A. There have been occasions, yes, where people have been disciplined for a lack of observation to

Page 259

standard operating procedures.
Q. So you can't guarantee today that even though Dyno Nobel has standard operating procedures that even your own employees are going to follow them on every occasion, true?
A. I can go off the information through recent circumstances within the company and within our Hermann, Missouri, site, and I've not had any situations in the last three years that I'm aware of where that has been enacted.
Q. But you would agree with me that even with Dyno Nobel's standard procedures and all the training you testified about you still have situations where your own blasters don't follow those procedures, true?
A. You're asking me to guarantee whether or not our guys -- I can ensure that our guys will do what they do? Do what they're supposed to do according to the SOP?
MR. MAUER: Could you read my question back, please.
(Whereupon, the requested portion of the record was read by the reporter as follows.)
A. Well, I would simply say I have no way to control whether or not they're going to follow the

Page 260

SOP as far as I don't have a puppet string to pull, but I have not had any circumstances recently out of our Hermann, Missouri, site where that has been the case, where I found a dereliction of following or complying with our surface operating procedure.
Q. (By Mr. Mauer) And you're aware that Magruder employs its own blasters; is that right?
A. Yes.
Q. And they do their own blasting at their Troy, Missouri, site, right?
A. That is correct.
Q. And you haven't performed any sort of appraisal or review evaluation on the blasters employed by Magruder?
A. I have not been asked to conduct such an appraisal.
Q. So have you done any sort of analysis as to the qualifications or training of the blasters employed by Magruder?
A. Not beyond knowing that some of them have the MLPA certification.
Q. And at this point in time there is no contract whereby Dyno has agreed that it will, in fact, blast on the Magruder site if a permit is granted, true?

Page 261

A. It's an oral agreement, and in the many years that I've known Magruders, I've never known the oral agreement to be rescinded. When they've offered us a job, we've always received the job from them.
Q. So is there -- is there a written agreement?
A. There is not a written contract.
Q. All right. And so there is nothing whereby Dyno has committed that if, in fact, this permit is granted we will do the blasting. You haven't committed to that in writing, true?
A. It's just been verbal discussions.
Q. And isn't it true, sir, that there's nothing so unique about this potential blasting that it would have to be a Dyno Nobel blaster necessary to implement the plan? Any certified blaster within the state of Missouri could shoot off those explosives?
A. Well, any certified blaster should be capable of carrying out the plan as listed.
Q. And you have investigated over 50 complaints from neighbors who have asserted some sort of damage caused by blasting to their neighboring property?
A. Yes. That's correct.
Q. And out of all of those situations, you've never, ever found one situation where you determined that blasting caused the damage to the foundation or

Page 262

as asserted by the neighbor; is that correct?
A. I've never seen a situation where there was an adjacent property owner that had damage that was the result of blasting activities. And, again, that's based on the U.S. Bureau of Mines RI 8507 information that's available. In the cases that I've investigated, the readings of the seismographs were always extremely low and well within compliance of those standards.
Q. But when you went into the neighbor's house or the neighbor's building and you saw -- they showed you cracks in the foundation, you couldn't determine or agree that the blasting caused the cracks in the foundation, correct?
A. Based on the information supplied in RI 8507 I could base that because that information is factually stated within the U.S. Bureau of Mines RI 8507. It's even referenced by -- on Mr. Dressler's website as a viable means of ensuring the safety of surrounding structures. It's an industry-wide standard. It's accepted by the Missouri Blasting Safety Act. And in order to, as you put it, crack the foundation and so forth, again, that standard was established in regards to the weakest building materials, and concrete, of course,

Page 263

would be stronger than the drywall or plaster listed as threshold damage in the report.
Q. So I think the answer to my question was no, in every one of those situations you could not determine that blasting caused any damage, correct?
A. No. What I said is based on the U.S. Bureau of Mine study RI 8507 and the seismic information that was available, there was nothing to suggest that all that -- any of those situations warranted such a conclusion. And in many cases, too, those have been followed up by subsequent investigations from third parties and were upheld.
Q. You have proffered some opinions about the City's sewer lines, and I want to ask, did you talk with anybody within the City of Osage Beach about those -- the installation or construction of those sewer lines?
A. No, I have not.
Q. Did you talk with anybody who actually did the construction of the lines?
A. No, I have not.
Q. Did you talk with the architects who designed the lines?
A. No. I reviewed the information that was sent to me in regards to the cross sections on those

Page 264

lines.
Q. And your testimony and opinions about the potential impact on those lines is based upon where Magruder says they're going to start the quarrying and what the impact may or may not be on those lines based upon that starting point; is that correct?
A. That is correct, because where they're talking about starting is the only place that they can logically access easily enough to actually start the quarrying operation.
Q. Could you turn to Page 2 of your report, please.
A. (Complies.)
Q. All right. And according to this slide, Page 2 of your report, Applicant's 10, you're calculating distances from a point within site A, which is where you've been told Magruder plans to start the quarrying, correct?
A. That was as was concurred with when we were looking -- or when the blast plan was developed was that was to be the starting location.
Q. And so that's the point that you utilized for calculating your distance, correct?
A. On that particular slide, yes.
Q. And isn't it true, sir, that you understand

Page 265

that the quarry, proposed quarry site, even comes down here to this far corner immediately adjacent to the overflow basins at the far end of the sewage treatment plant?
A. Well, actually I did state earlier that I drew those lines in, and I don't have that particular -- I don't know that I have that particular line precisely where it should be, but blasting, again, in that shallow of materials, it's at a highly graded area right there, is going to be pretty prohibitive. If there was any blasting in that area, it would have to start further up the hillside for mineable rock.
Q. Is it true, sir, that you didn't determine any calculations as to how close the proposed mine quarry site would be to the corner of that sewage treatment plant? Is that right?
A. I think I stated pretty clearly earlier that the fact of the matter is that there -- we would re-risk assess anything that would move beyond the scope of A, B and C. In fact, my scope of the risk assessment would take care of A, and I would re-risk assess at the time when we would intend to move to B, C and so forth.
Q. So the answer to my question is yes, you

have not performed any calculations about how close the proposed quarry site would be to that point that I just referenced, correct? You haven't done that yet?

A. The last time I was looking through these plans, the distance that is closest to the nearest mineable elevation of rock was approximate -- less than 400 feet, right around 400 feet.

Q. Is it true -- okay. I want to be sure now. I'm going to ask one more time. Is it true that you did not even perform any calculation as to how close the proposed mine quarry site would be to the corner there of the sewage treatment plant?

A. The actual corner, the property corner itself?

Q. Yes, sir.

A. No, I have not done that.

Q. Thank you. And isn't it true that you have not calculated what the vibration level would be for any pipes that may be feeding that sewage treatment overflow basin?

A. In relation to site A?

Q. No. With relation to the same point I'm talking about on the far end of the sewage treatment plant away from the front entrance.

A. Well, again, as I stated earlier, we would -- any further development of this property over here would be re-risk assessed, and then that is when the actual calculations would take place at that point in time.

Q. So you haven't --

A. But I have absolutely no concern that that would be any more difficult to overcome than what we were dealing with up here. We can adjust the blast plan accordingly to ensure the protection of the pipe.

Q. But you haven't prepared any of those calculations or done that plan at this point, true?

A. No, because we're referencing site A, B and C, and primarily site A.

Q. And isn't it true that you have not performed a calculation to determine what level of vibration will damage the concrete sewer basins that are there on the far end of the sewage treatment plant?

A. Can you repeat that question?

Q. Is it true that you have not performed a calculation to determine what level of vibration will damage the concrete sewer basins there on the far end of the sewage treatment plant?

A. Okay. Again, I mentioned earlier that the concrete basins, the sewer treatment plant itself would fall under the government -- governance of the Missouri Blasting Safety Act, and as a result that particular location would be applicable to the Appendix B curve RI 8507 which reflects the weakest type of building material, which is drywall and plaster, and in that regard concrete would be a much stronger substance to blast against. So in that particular situation, our -- any blast plan that we would enact, being Dyno Nobel, would have to fall within the criteria to ensure the safety of that particular structure.

Q. Sir, I appreciate that great big long answer. My question simply is, you have not performed those calculations yet; is that true?

A. I have calculated an expected vibration earlier. I don't have the results directly in front of me as far as in relation to this particular -- what part of the property are you looking at?

Q. I'm still talking about this basin that's here on the far end of the sewage treatment plant immediately adjacent to this point of the proposed quarry site.

A. Again, as I stated earlier, referencing it

would be difficult for me to actually make that calculation because there has been no concrete point at where that mining the actually -- could take place because the elevation is such that based on the current mining plan the elevation would actually be further back on the property.

Q. So you haven't done that yet, correct?

A. No, because we're not back there.

Q. Thank you.

A. And we can't even feasibly get back there. That's why, because the property access is such that we have to go through property to even get to that section.

Q. Let's talk about the line along Lodi, Missouri, the Lodi, Missouri, quarry. Do you know what the pressure is in that line?

A. No, I do not. And when we were actually looking into the considerations for blasting that particular site, we weren't concerned with that. All we were concerned with was --

MR. MAUER: Your Honor, move to strike. My question was simply does he know the pressure.

HEARING OFFICER: The answer is non-responsive. Mr. Henderson, if you will, simply

Page 270

listen to the attorney's question. Do not anticipate what he's going to ask you. Just simply listen to what he says, and if you can, answer it yes or no. Your counsel on redirect can fill in or give you an opportunity to further explain.

MR. HENDERSON: Okay. Thank you.

HEARING OFFICER: All right. Restate your question, Mr. Mauer.

Q. (By Mr. Mauer) Mr. Henderson, do you know what the pressure is in that line as represented in your Lodi, Missouri, example?

A. No, I do not.

Q. And is it your understanding it is made of steel?

A. Yes. That's correct.

Q. Have you done anything to confirm the depth of that line?

A. Not other than the information that was given to us by the owner of the pipeline.

Q. Have you done anything to determine the actual diameter of that line?

A. The diameter was given to our site manager at the site, and I don't recall at this time what the particular diameter was.

Q. Have you done anything to evaluate the

Page 271

actual construction of the line?

A. No, I have not.

Q. Do you know or have you reviewed any construction information about that line to know what type of bedding, the type of backfill material, anything like that?

A. No, I do not, because it wasn't relative to that circumstance.

Q. Have you reviewed any information to determine what joints or joint structures were utilized for that line?

A. No, again for the same reason.

Q. You've mentioned a study RI 9523.

A. That's correct.

Q. In RI 9523, they did not test ductile iron pipes; is that true?

A. That is correct.

Q. And did they test -- in RI 9523 did they test the types of joints utilized in the 18-inch sewage treatment line that's in ground on the Magruder facility?

A. I'm sorry. Could you repeat that?

Q. In the RI 9523 study did they test the types of joints utilized on the 18-inch PVC sewage treatment line that is actually in ground on the

Page 272

Magruder property? Did they use the same type of joints?

A. Slip joint pipe is what they had tested in that study.

Q. And do you know if that's the same type of joints that are utilized on the 18-inch Magruder -- 18-inch sewage treatment line that is on the Magruder site?

A. To my knowledge, that is the joint type that was utilized.

Q. And is it true that the blasts at the Capital Quarries that you testified about are not the same type of blast that's going to be utilized at the Magruder site?

A. No. I believe I was pretty clear that it was a 3-and-a-half-inch hole, but the bench heights were equivalent and the same.

Q. And with respect to the Capital Quarries, you've not actually gone to anyone at Wal-Mart and asked them if they've experienced any problems; is that correct?

A. No, I have not.

Q. And you haven't gone to the Stadium Plaza to actually investigate if they've experienced any problems as a result of the blasts?

Page 273

A. No, I have not. We usually are contacted right away when someone believes they have an issue.

MR. MAUER: Your Honor, move to strike the last response as non-responsive.

HEARING OFFICER: It's non-responsive. It is stricken.

Q. (By Mr. Mauer) Would you please turn to Slide -- I think it was Number 29 that shows the power lines at the Capital Quarry site?

A. (Complies.)

Q. Bingo. Isn't it true that you don't know how those lines were actually installed?

A. That is correct.

Q. And isn't it true that you don't know how they were installed in comparison to the Ameren lines that are on the Magruder property?

A. That is correct.

Q. With respect to the sewage treatment plant, do you know what type of mix of concrete was utilized to form the -- to prepare that sewage treatment plant?

A. No, I do not.

Q. Do you know what type of rebar or reinforcement was utilized throughout the plant?

A. No.

Page 274

Q. Do you hold yourself out as an expert in concrete?
A. No.
Q. On Page 29, the next slide, you referenced a structure response to concrete. Is it true, sir, that you don't even know what massive concrete as referenced by Mr. Oriard means?
A. In that particular situation massive concrete -- I looked up this morning that massive concrete is anything that is basically not free from movement on the ground.
Q. With respect to Mr. Oriard's report, is it true that you are not sure what he's referencing in particular to as far as what he's considering to be massive concrete?
MR. BROWNLEE: He's answered that he's --
MR. MAUER: He said he looked it up this morning.
MR. BROWNLEE: Well, then he looked it up this morning. That's an answer.
HEARING OFFICER: He looked it up this morning.
MR. MAUER: My question was different, your Honor. Let me try again.

Page 275

Q. (By Mr. Mauer) Is it true, sir, that you don't know what Mr. Oriard is referring to when he says massive concrete in this report that you've quoted?
A. Well, again, I looked it up this morning. Massive concrete is concrete that is not free standing, in other words, it's in contact with the ground and doesn't have...
Q. And are you characterizing the concrete in place at the sewage treatment plant as massive concrete?
A. In regards to the fact that it does not have freedom of movement from the ground, yes.
Q. Do you remember giving your deposition last week?
A. Yes.
Q. Let me show you Page 198 of your deposition. Do you see the parts that I've highlighted, put a circle around?
A. Yes, I see that.
Q. Did I ask you this question, and did you give this answer?
A. Yes, you did.
Q. And that was your testimony under oath?
A. Within that realm of knowledge that day.

Page 276

Q. And your testimony was, just so we're clear, "Are you characterizing the concrete in place at the sewage treatment plant as massive?" And your answer was, "I do not have an opinion as far as whether it's massive concrete," correct?
A. As of the date of the deposition, that's correct.
Q. Thank you. Now, with respect to the sewer lines, isn't it true that you don't really give a crap about what the lines are made out of?
A. In regards to the sewer lines, I do not have a concern as to what their current make-up is based on the distance to the proximity to the blast and the information we have related to sewer line response and buried utility response in regards to the study of 9523.
Q. Because, in fact, you believe you couldn't really give a crap less what the pipes are made out of, that's really irrelevant. Is that true?
A. That is what those -- at that location, it is irrelevant.
Q. And what the bedding material is made out of is irrelevant?
A. That's correct.
Q. So the kind of pipe just doesn't matter; is

Page 277

that correct?
A. The pipe moves in conjunction with the ground, as stated within the studies and in the examples I provided, and as such, since it moves in conjunction with the ground, the type -- that particular type of pipe being PVC and ductile iron were of no concern in my assessment of that location.
Q. Could you go to your picture of the Capital Quarry.
A. Which particular one?
Q. Keep going back. The one of the aerial view of the Google shot.
A. (Complies.)
Q. Thank you. With respect to that picture, there is a ditch between the northern face of the quarry and the Wal-Mart store; is that true?
A. Yes.
Q. And even though there is a ditch between Wal-Mart and that Station 8A, that does not mean that Wal-Mart won't feel the vibrations and the impact of blasting, true?
A. Well, as I stated in the first slide is that vibration and air blasts are a byproduct of the blasting.
Q. And they will feel ground vibrations at the

Page 278

Wal-Mart?
A. Ground vibrations will be felt at Wal-Mart. They're monitored at Wal-Mart.
Q. Thank you. When you were actually doing a blast, you had a safety zone where you made people move away from the blast site; is that correct?
A. That is correct.
Q. And you would typically move people in excess of 1,000 feet away from the blast site?
A. It depends on the blast site and the blast location, but, for instance, in a quarry situation like this, the loading is adjusted such that -- to help ensure additional safety so that the safety zone can be decreased, because it's not possible for us to evacuate Wal-Mart during the middle of the day.
Q. Would you say that it would be a minimum in front of the blast of at least 600 feet?
A. Again, it depends on the location. And in most cases we actually have crushers within far closer proximity to that. So we usually have to try to restrict our blasting. In a case where a crusher is not in front, then we could do as much as 600 feet or even greater if we deemed it necessary.
Q. Are you going to allow somebody to sit on the crusher when you're blasting?

Page 279

A. No, we do not allow someone to sit in the crusher when we're blasting.
Q. So I'm talking about people. How far away are you going to make people stay, a minimum of 600 feet?
A. Well, again, it depends on the circumstances. For instance, here again, we enact tighter standards and we adjust the loading such that -- to help ensure against -- or to help provide a smaller safety zone. In a quarry where there's something not in such close proximity, typically we wouldn't allow someone to be within 600 feet if we're doing different blasting practices.
Q. I think that last answer got me there. On the next -- the third page of your -- go all the way back to the beginning of your report. I can move through that, and then I think I'm about done.
A. Which page? I'm sorry.
Q. All the way back to the beginning, please.
A. (Complies.)
Q. Actually, now if you can go forward two slides.
A. (Complies.)
Q. Bingo. When you testified, you said that there would be approximately -- based on the

Page 280

300,000 tons per year, there would be approximately a shot or week or two or three shots a month; is that right?
A. That's correct.
Q. But that assumes that the tonnage is being quarried all at the same rate throughout the year, right?
A. Yes.
Q. And isn't it true that in quarry operations quarrying operations are somewhat seasonal? You're not going to blast on the same day every month all throughout the year, true?
A. We have quarries that run all year round. It depends on the market conditions. If the market conditions and the demand is still up in some of the warmer winters, as it has been in the recent times, we've run almost completely full open in those quarries, as we do others. It depends on the market conditions.
Q. So the market conditions would determine how often you need to blast at the proposed Magruder site?
A. Well, their need or their ability to crush the amount of material would be the largest determining factor. If their crusher was capable of

Page 281

crushing a higher output, then they could feasibly blast more often.
Q. Two more pages. Actually, the next two pages show your sample blast plan, and I just want to be sure, this is just an example of what might be used at the Magruder site, correct?
A. Well, it was an illustration of a possibility to achieve one hole per delay. There are several -- there is actually a few different designs or more that could be employed to achieve one hole per delay.
Q. All right. Next slide, Slide 6, actually. One more.
A. (Complies.)
Q. Thank you. Now, I believe did you testify that unrestrained, unrestricted structures were like the uncontrolled structures identified in the Missouri Blasting Safety Act?
A. Well, what I was making reference to is that an unrestrained structure is one that is not attached -- or I'm sorry -- that is not completely restricted by the ground. In other words, it's attached at the ground, but it has free standing above it. And when I referenced the houses, I would, you know, reference that that would be similar to the

Page 282

uncontrolled structure. Now, the tower and bridges wouldn't fall under that particular standard because they're not listed.
Q. Right. Because towers and bridges aren't specifically identified as an uncontrolled structure within the Missouri Blasting Safety Act either; is that correct?
A. That's correct.
Q. Yet those are unrestrained or unrestricted structures which you agree need to be evaluated in any blast plan?
A. Well, when we develop -- or when we're going into blasting, we consider all the items that are immediately around us. We take all those items into consideration.
Q. Please turn to Page 14.
A. (Complies.)
Q. In your comparison between the U.S. Bureau of Mine Safety Study that we've heard about and the proposed blasting at the Magruder site, you made a reference at the bottom that there would be 12-and-a-quarter-inch hole with more explosives; is that right?
A. At the U.S. Bureau of Mines site, they used a 12-and-a-quarter-inch hole.

Page 283

Q. And it was more explosives, right?
A. Compared to --
Q. The proposed Magruder site.
A. Yes, that's correct. There would be more pounds per foot.
Q. And if the testimony of Dr. Worsey was that more explosive actually generates less vibration, would you disagree with that?
A. Well, it depends in the particular context of what he says. There's variables in there that, for instance, a 12-and-a-quarter-inch hole with 41.9 pounds per foot is as a rule going to generate more -- it's going to generate more vibrations than a 4-inch hole with 4.46 pounds per foot. Now, in relation to the -- Worsey's statement in the blast plan, his reference is that if you actually increased the powder factor or, in other words, tighten the pattern up, that it allows for more ease of movement, so as a result you could have more ease of movement. But, again, you know, it's relative to those particular circumstances.
Q. In fact, for each evaluation and each study, you have to know many factors in order to determine if they're applicable or not, true?
A. Could you clarify that question?

Page 284

Q. Well, you have to know the size of the hole, the amount of explosives, you have to know how much was packed into the hole, you have to know the distance to the pipeline, you have to know the type of rock it was going through or soil or the materials, true?
A. We have to go through a number of variables when considering the blast plan or a blast design to use.
Q. Thank you. Please turn to Page 16.
A. (Complies.)
Q. And in your first bullet you talk about being within 10 to 20 feet of a pipeline?
A. Yes.
Q. Do you know what type of material that pipeline was made up out of?
A. I don't recall on that particular bullet point what the material type was.
Q. Do you know if they were blasting through soil or rock?
A. Well, they were blasting through rock because you don't have to blast soil.
Q. You're not aware of any tests that would have evaluated the blast impact through soil?
A. Well, you asked in reference to that bullet

Page 285

point there. As far as I know, that was blasting in rock.
Q. Do you know, or is that just your assumption because you don't blast in soil?
A. In that particular bullet point, without referencing the report straight away, I wouldn't be able to reference directly if that was in rock.
Q. Okay.
A. Per se, but again...
Q. And the last bullet point, according to Kiker, the risk to the pipeline was movement; is that right?
A. Actual ground rupture or movement of the material.
Q. So if the ground around a pipeline moves, that can cause a danger or risk to the pipeline?
A. No. That would be -- well, that would be -- the ground vibrations, there's a differentiation in this actual fact of ground rupture or movement would be actual permanent displacement or pushing of material into the pipeline itself. That's why it -- that's why he says not from vibrations per se.
Q. I understand that. But the movement of the pipeline or the ground around the pipeline is what Kiker is referencing that poses a risk to the

Page 286

pipeline?
A. No. It's material moving into the pipeline or shoving into the pipeline.
Q. Okay. Page 18. The study there was welded steel pipelines, not ductile iron or PVC, correct?
A. That's correct.
Q. And even though those welded steel pipelines are there, they are very -- they are sensitive to the shifting of ground, correct?
A. That's why it says ground control is essentially for prevention of damage.
Q. So the shifting of ground can cause a risk of damage to the pipeline?
A. When blasting is very close.
Q. So is the answer yes, a shifting of ground can cause a risk of damage to the pipeline?
A. That's correct, if you were blasting in a very close proximity where you could actually cause permanent displacement.
Q. Well, if the risk is the shifting of the ground, what counts is that if the ground is shifting, right? Whatever the distance is that the blast caused. If the ground is made to shift, that's what poses the risk to the pipeline, correct?
A. A permanent displacement or a permanent

Page 287

shift.
Q. Thank you.
A. Which is not related to ground vibration.
Q. And in your next slides after the Lodi, Missouri, your first point, just so we're -- two back. Sorry. There we go. That was actually a measurement that you did, but it was 170 feet away, not 150 feet, right?
A. Yes. It says 170.
Q. And the next one? That was 185 feet, not 150 feet, right?
A. That's correct.
Q. Are the basins, the concrete basins, at the sewage treatment plant, are they covered under the Missouri Blasting Safety Act?
A. The Missouri Blasting Safety Act controls uncontrolled structures.
Q. Are they an uncontrolled structure?
A. They would not be listed as an uncontrolled structure.
Q. So they're not covered by the Missouri Blasting Safety Act as an uncontrolled structure?
A. They're not listed as an uncontrolled structure in the Missouri Blasting Safety Act.
MR. MAUER: Nothing further.

Page 288

HEARING OFFICER: Thank you, Mr. Mauer. Mr. Duggan?
MR. DUGGAN: No questions.
HEARING OFFICER: Thank you, sir. Before I ask for redirect, just so I've got it straight on my exhibits, Mr. Brownlee, you're moving for Applicant's 10 to be admitted into evidence?
MR. BROWNLEE: Yes.
HEARING OFFICER: Any objection to Applicant's 10?
MR. MAUER: Actually, your Honor, I would object to portions of Applicant's 10, basically from Page 29 on. I do not believe that this witness testified about them, and he certainly did not testify about 29, 30, 31, 32 or 33. And further, in cross he admitted he was not an expert in concrete. Simply all he's doing is quoting out of a report. He's not -- he's not an expert on that and cannot formulate anything. The same would be for Page 34. And then from Page 36 --
HEARING OFFICER: Wait just a moment. You're objecting to 29, 30, 31, 33 and 34? What other pages?
MR. MAUER: 32, your Honor.
HEARING OFFICER: 32.

Page 289

MR. MAUER: He did testify about Page 35, so I'm not objecting to that. This all has to do -- and his report has to do with concrete, and I believe he testified he's not an expert in concrete, does not hold himself out to be an expert in concrete, has not evaluated the sewage treatment plant, has no knowledge about the construction of the sewage treatment plant. I would object to those pages.
HEARING OFFICER: All right. Your objection to Pages 29, 30, 31, 32, 33 and 34. Mr. Brownlee, response?
MR. BROWNLEE: Assuming these are the pictures of the adjacent homes, is that --
HEARING OFFICER: No. I think this begins with structure response concrete.
MR. BROWNLEE: I think he can rely on testimony as an expert of learned treatises and studies. I think that's an exception to the hearsay rule. And, again, he's checked as to what Mr., I believe, Oriard has defined as massive concrete. And if it comes from that treatise, which I guess I could ask him on redirect... But the pictures of the other homes and the valuations, we haven't gone into it.
MR. MAUER: He wasn't questioned

Page 290

about these pages on direct.
MR. BROWNLEE: I said I don't object to it. I said we didn't question him.
HEARING OFFICER: Well, I want to make sure the two of you are talking about the same pages. The pages that I understood were objected to were those pages which related to the citations out of the Oriard and other -- Oriard on cracking of concrete from vibrations, although he testified under cross-examination on 28, but then on 29, 30, 31, 32, 33, 34... Let me see the witness' copy of the exhibit.
MR. BROWNLEE: I think he's waived any objection. He's the one that raised about the concrete, and I have it open to me to ask him on redirect.
HEARING OFFICER: Well, that's what I was thinking, Mr. Brownlee. It's been opened, and beyond that the witness can certainly rely upon learned treatises. As you pointed out, it's an exception to the hearsay rule, and Mr. Oriard has been referenced extensively in the hearing by this witness and the previous witness. Objection is overruled.
MR. MAUER: Your Honor, also from

Page 291

Page 36 on of his report, this is the information about some other homes in St. Charles County. There's been no testimony about that. The rest of his report from Page 36 on was never discussed, never referenced. No video was shown. The picture of his house was not shown or discussed. I would object to those portions of the report from Page 36 on.
MR. BROWNLEE: I have no problem with that.
HEARING OFFICER: All right. Pages 36 on are stricken, withdrawn. The exhibit is received as Pages 1 through 35 and admitted into evidence. What about as to Applicant's 25?
MR. MAUER: Other than my objection already noted, your Honor.
HEARING OFFICER: All right. Objection has already been noted and ruled on. Applicant's 25 is offered and admitted into evidence. Mr. Brownlee, what about as far as Applicant's 24, copy of Senate Bill 882 in its original introduced form?
MR. BROWNLEE: What about it? I mean, yeah, I'd like to --
HEARING OFFICER: Any objection?
MR. BROWNLEE: It's a matter of

Page 292

record anyway.
MR. MAUER: Yes, your Honor. It's not an authenticated copy. If it were a public record, it would still have to be authenticated. And it's an incomplete copy. All I have is through Page 4, which certainly does not include the complete Senate Bill 882. It ends on Page 4. So even at that it is an incomplete copy of public record, so I would --
HEARING OFFICER: Objection is sustained. All right. I believe those are all the Applicant's. Mr. Brownlee, redirect?

EXAMINATION

QUESTIONS BY MR. BROWNLEE:
Q. At the initiation of Mr. Mauer's examination, or cross-examination, he asked you a number of questions regarding your lack of formal education on pipes and plants and concrete and electric panels and basins, and you never visited the site, you didn't review pipeline construction. I'm not going to go through that. We've heard it in the deposition, we've heard it today. Having no specific knowledge on that and then again relating to your 16 years of experience in blasting around structures and pipelines, do any of those -- any of that lack of

Page 293

formal training and formal knowledge and formal assessment change your opinion in anyway as to the effect of the blasting proposed on the Magruder site that would have any effect on either the sewer line or the sewer plant?
A. No, not at all, because we blast near -- we being Dyno Nobel as a company have blasted near pipelines and near structures ever since our inception and ever since we've been doing blasting. We blast near structures and we have a number -- as I presented, we have a number of pipelines we blast directly next to already. And those are just a few examples. There is more examples throughout the country.
Q. And for you to be -- if when you blast around it, if you had to determine that and if it was significant to know all of those factors, how would you determine that from an adjacent -- in determining what was actually the condition of an adjacent or close in proximity pipeline? What would you have to do?
A. To actually determine how it is currently in the ground?
Q. The joints, the flanges, the material, the age, the construction, the color, the smell, any of

Page 294

that. What would you have to do to determine that?
A. Well, you'd have to rely on the information supplied by the --
Q. No. If you wanted to actually check as to the bedding and everything on this pipeline on the Magruder site, what would you have to do to personally determine all of those factors?
A. Well, the only way to personally determine what every single factor is is to dig it up.
Q. Okay.
A. That would be about the only way to ensure that those are the actual cases.
Q. And in your experience, having never seen a pipeline damaged by blasting vibrations, have you ever seen a pipeline damaged by people digging around it?
A. Yes.
Q. And do you know whether, in fact, this has ever happened at the Osage Beach situation, where they damaged a pipeline by digging around it?
A. I was aware of a recent damage that ensued, I guess, sometime in the very recent weeks.
Q. And was that to the pipeline we're talking about here, the big ductile steel line?
A. To my knowledge it was.

Page 295

Q. And do you know whether that damage -- how long that occurred?
A. Not sure of the exact amount of time, but it was several hours, from my understanding.
MR. MAUER: Your Honor, foundation for this knowledge.
MR. BROWNLEE: Well, we'll get back to that on rebuttal.
MR. MAUER: Well, I'd like to know the foundation. I'm going to object to that lack of foundation without any sort of information about how he knows.
HEARING OFFICER: Mr. Brownlee, do you wish to tie that up as to how this witness knows?
MR. BROWNLEE: I will with another witness on rebuttal.
Q. (By Mr. Brownlee) Have you seen pipelines damaged --
MR. MAUER: Then I move to strike, your Honor. If he can't establish foundation on how this witness knows, then I move to strike.
Q. (By Mr. Brownlee) How do you know?
A. I spoke with Dean McDonald about it.
Q. In your experience in working around pipelines, have you seen pipelines damaged by

Page 296

construction?
A. I've never seen a pipeline damaged by blasting. And the only time I've ever seen one damaged by construction was when it was actually dug into or accidentally ruptured by a piece of equipment.
Q. Okay. Now, on the Lodi quarry site, again the same series of questions. You didn't know the pressure, did you?
A. That's correct.
Q. You didn't know the depth, you didn't know the diameter, you didn't know the actual construction, you didn't know the bedding, you didn't know the backfill, you didn't know the joint, the joint structure, you didn't know the engineer, you didn't know the architect. Again, having -- not having any of that knowledge, does that affect your opinion or how you would treat blasting near that pressure pipeline at the Lodi site?
A. No. Again, our main concern is just to make sure that we stay within the standards recommended by the U.S. Bureau of Mines. The blast itself -- or the pipeline itself is going to move in conjunction with the vibration. So the fill material in there doesn't matter because the fill is going to move as the pipe

Page 297

is going to move. Everything is going to move in conjunction that's buried under the ground. They're going to move in unison.
Q. And that is true with any buried pipeline; isn't that correct?
A. That is correct.
Q. Whether they're in Lodi or Magruder or whether they're in Timbuktu?
A. They have no choice but to move with the ground because they're buried within ground. They're restricted by the ground, so they're restricted in what kind of movement they can make.
Q. Turn to Page 29 of your slides, which Mr. Mauer discussed the massive concrete area. And is that, again, work by Mr. Oriard that you relied on regarding blasting around concrete?
A. Yes.
Q. And since the deposition that you gave, I believe last week, have you made a determination and you've testified what massive concrete is?
MR. MAUER: Your Honor, again I would just note my objection. And unlike the sewer pipeline, I was given no information that there would be additional work done by this witness and additional investigation about this concrete or

Page 298

anything else. That was not told to me in this deposition.
HEARING OFFICER: Mr. Mauer, you asked the question about massive concrete.
MR. MAUER: I understand that.
HEARING OFFICER: The witness is certainly entitled to respond the knowledge that he has now. I don't know of any rule of discovery that requires him to call you because he went and looked up the standard within the industry for massive concrete. The objection is overruled.
Q. (By Mr. Brownlee) And again just quickly, the purpose of your slide at 29, what does that illustrate?
A. Well, the Slide 29 just illustrates a study by Oriard about cracking of concrete from vibrations, and in that he concluded the massive concrete is understandably very resistant to vibration-induced cracking. The work by Oriard in 1980 specified some historical guidelines for new or green concrete that is not yet fully cured of 2 to 4 inches per second, which is -- again, that's over the level that we would have to maintain within the Missouri Blasting Safety Act.
And, again, we're not going to try to

Page 299

encroach as close as we can to those levels anyway. So that's for not yet fully cured concrete. And he estimated a more realistic safe level of 10 to 20 inches her second after seven to ten days. The American Concrete Institute recommends similar criteria of peak vibrations of 2 to 7 inches per second. So, again, the fact that the concrete that is in place at the sewer treatment facility would fall under the criteria and the basins as massive concrete because it can only move as the ground moves and again in that particular situation we would have to maintain a level below the standard set by the Missouri Blasting Safety Act, that would be below the 2 inches per second anyway that's listed here on the recommendation.
Q. So it would cause -- again, does that change your opinion about blasting around the sewer plant in terms of the effect on the concrete or the basins?
A. No.
MR. BROWNLEE: Excuse me a minute. We've got this -- seemingly this document has got about four of the same pages.
Q. (By Mr. Brownlee) Turn, if you would, to Page 34.
A. Okay. In the presentation this is the same

Page 300

as what 34 would be on -- unfortunately, I had a duplicate of the slide, same slide.
Q. You haven't testified -- what's the purpose of this slide, which is demonstrated as 30, structure response concrete that starts "In actual tests"?
A. Again, just further information that in actual tests Oriard found that over 100 inches per second vibration was required to crack eight-day-old concrete and that old concrete could withstand 375 inches her second.
Q. And what would be the blasting inches per second on the concrete at the Magruder site and the sewer pipe?
A. We would have to maintain under 2 inches per second. And, again, we would not even try to encroach that close.
Q. So Oriard found that it could withstand 100 inches per second on eight-day and 375 inches per second on old concrete. And how does that relate again to the Magruder site?
A. It's many times greater. In that case it's -- you know, the 100-inch-per-second is 50 times greater, and I don't know what the multiple would be, 375 compared to 2 inches that we would be required to maintain as a result of the sewer treatment facility

Page 301

being there at the site.
Q. What about 32, structure response concrete? It starts "Massive concrete." Have we covered that one?
A. Yes. That -- I believe that's --
Q. No. The other way. That's 29.
A. Yeah. But I think that is the duplicate. You said it starts "Massive concrete is understandably"... That was one of the duplicates.
Q. What about please refer to Slide 34. No. One more. That one. Is that a summary on the criteria of blasting around concrete?
A. Yes. It just simply states that freshly or newly poured concrete is susceptible to damage during the hydration process, which the hydration process itself can be affected by the curing rate depending on the type of additives or the weather or various other information. So these specs were based on 28-day strength of concrete.
Q. Now, aside from your reliance on the Oriard study on concrete, from your practical experience of 16 years of blasting around concrete and structures, do you feel that the standards imposed by the Missouri Blasting Safety Act, the standards that Dyno will follow, will completely protect the sewer plant

and any of its adjacent basins or of its other appurtenances?
A. Yes. Again, the standards put forth by the Missouri Blasting Safety Act would make it necessary for us to maintain under the 2 inches per second criteria. And the other thing is that in my own personal experience on one particular occasion I actually blasted a 100-plus-foot-tall high wall using 5-and-a-half-inch diameter bore holes within 70 to 80 feet of a concrete tunnel on a customer's site. The tunnel is crucial to their actual operation. It was the tunnel that held the surge piles for the rock that would be taken across the road to be crushed for cement. And we actually exceeded 8 inches per second on a seismograph that was mounted on the concrete wall itself, and the concrete wall was inspected afterwards and found to have had no damage related to it. And that was blasting within 70 feet, again, a 100-foot face with a large amount of explosives per hole.
MR. BROWNLEE: I have nothing further. Thank you, sir.
HEARING OFFICER: Mr. Brownlee, you need to prepare a clean copy of Applicant's 10.
MR. BROWNLEE: Yeah. We're going to

get that.
HEARING OFFICER: Slides 1 through 35. There's no need to prepare the others. Any recross on points covered, Mr. Mauer?
MR. MAUER: Yes, your Honor.
HEARING OFFICER: Proceed.
EXAMINATION
QUESTIONS BY MR. MAUER:
Q. Mr. Henderson, with respect to that 100-foot concrete tunnel, this tunnel that you just talked about, is it true that you don't recall the thickness of that concrete?
A. The only thing I know is that the concrete was in excess of -- or 8 inches.
Q. But you don't know how thick it was?
A. I don't know the exact thickness of the concrete wall.
Q. And is it true, sir, you don't know the thickness of the concrete utilized throughout the sewage treatment plant?
A. That's correct.
Q. And you don't know what kind of rebar or other reinforcement was utilized in the tunnel, the concrete, correct?
A. I do know the tunnel had some reinforcement,

but I don't know on what kind of spacings those were set or the size of the rebar or anything like that.
Q. And you don't know what type of reinforcements, rebar, may or may not have been used in the sewage treatment plant, correct?
A. That is correct.
Q. Would you please turn back to Page 30.
A. (Complies.)
Q. Should have been just two from where we were. Going the wrong way. One more. There we go. With respect to this, isn't it true that you don't know the thickness or the construction of the old concrete that was identified and utilized in Mr. Oriard's report?
A. That is correct.
Q. And you would agree with me that not all concrete is the same, true?
A. As far as thickness?
Q. Make-up, construction, reinforcement. Concrete can differ, true?
A. That's true.
Q. And isn't it true, sir, you've never received any training or information about how to analyze the construction of a sewage treatment basin?
A. As I answered before, yes.

Q. That is a correct statement, right?
A. That I've not received any training in the construction of the sewer basin?
Q. Yes.
A. That's correct.
MR. MAUER: Thank you. Nothing further.
HEARING OFFICER: Any redirect on those points or any questions?
MR. BROWNLEE: (Shakes head.)
HEARING OFFICER: All right. That concludes the testimony of this witness. Thank you, sir.
MR. HENDERSON: Thank you very much, sir.
HEARING OFFICER: You are excused, and with that, that concludes our day's work. We will reconvene, I don't know whether it will be in this room or the next, Bennett Springs or here, but we will reconvene at 9:00 on Friday, and at that time, as previously discussed, Mr. Dressler will be presented as the Petitioner's witness, and we will then move from that to any rebuttal testimony which any party wishes to tender at that time. With that, we are adjourned and off the record.

CERTIFICATE OF REPORTER

I, Judy K. Moore, Certified Court Reporter within and for the State of Missouri, do hereby certify that the meeting aforementioned was held at the time and in the place previously described.

IN WITNESS WHEREOF, I have hereunto set my hand and seal.

_____

JUDY K. MOORE, CCR #1121
Certified Court Reporter
within and for the
State of Missouri